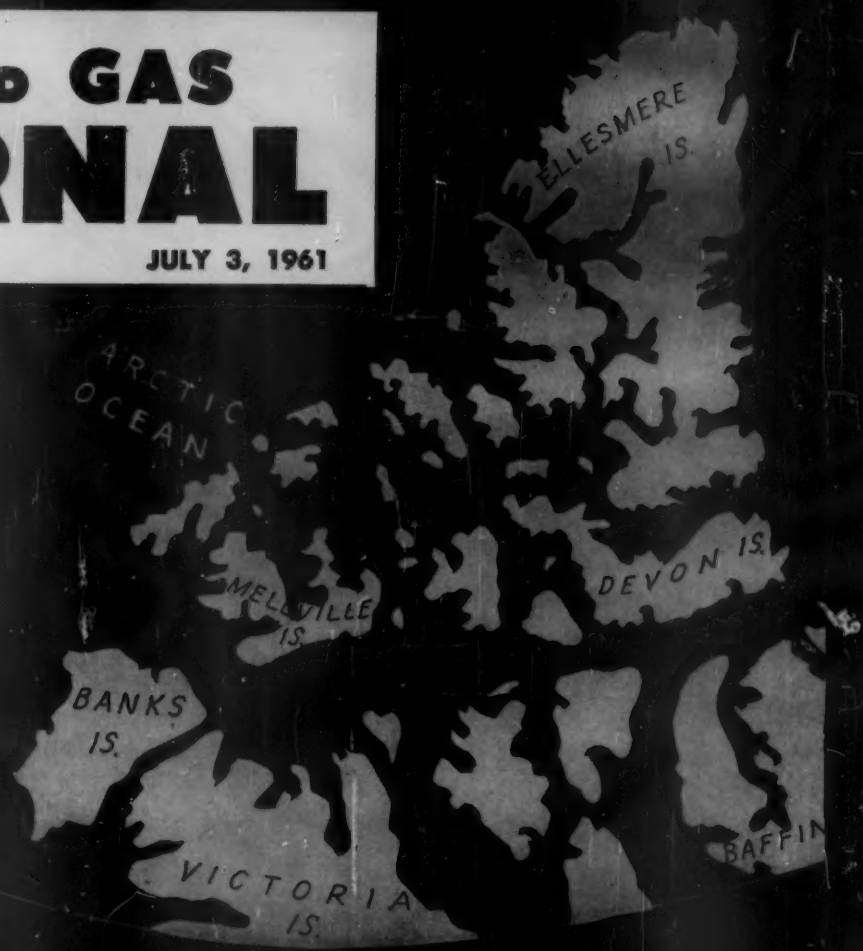
the OIL AND GAS JOURNAL

PUBLISHED WEEKLY JULY 3, 1961

The Canadian ARCTIC

. . . More oil than western Canada?

p. 76



Alberta outlines its gas-liquids policy ▸ 73

Jet-fuel problem: Are bacteria to blame? ▸ 82

What's behind IPC's troubles in Iran ▸ 97

Oil industry moves further into aromatics ▸ 116

Spanish Sahara offers real prospects ▸ 182

These nine vessels, each 30 feet in height and 8 feet in diameter, and fabricated in Wyatt's Houston Plant, comprise one of the world's largest desiccant natural gas dehydration plants. The plant is in operation on the Columbia Gulf Transmission Company main line system at Rayne, Louisiana.

BUILT for the JOB

Automatic Removal of Water from 690,000,000 Cubic Feet of Gas Daily

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OIL AND GAS JOURNAL
Vol. 59, No. 27

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TECHNOLOGY—OPERATION

Drilling-Production

How to Eliminate Wasteful WOC Time 104
By William G. Bearden and Robert D. Lane
A generous bonus in rig time awaits adoption of latest thinking about "waiting on cement" time, these authors declare. Usual WOC time is now about 24 hours. Recent field and lab tests show that 8 hours is usually enough. If cements are carefully chosen, they develop needed strength and thickening well within the 8-hour period.

Aluminum as Propping Agent for Fracture Treatment 110
By T. K. Perkins, L. R. Kern, and R. E. Wyant
Here is some quantitative information that will help you "engineer" your fracture treatments. Some design curves are included to give quick estimates of conductivities for various conditions.

Oil-Well Pumping—46 133
By Joseph Zaba
Hydraulic pumping—the subsurface unit.

Concrete Doughnuts Reduce Field-Gathering-Line Corrosion 134

Water-flood Watchdog 137
Simple, easily used device detects early corrosion in pipelines carrying injection water.

Refining-Processing

Refinery Cost Indexes 115

Processing Notes 116
Petroleum industry moves further into aromatics—Phillips Butamer unit on stream—Car engines only half as efficient as theoretically possible.

Quarterly Costimating 118
Tabulated values of refinery operating cost indexes.

Carbonyl Test Detects Wax Odor 121
By M. E. Peterkin and J. W. Loveland
Certain odor-causing compounds in wax make it unsuitable for many applications such as coating paper, fiber board, and milk cartons. This study shows that there is a reasonable correlation between colorimetric tests on carbonyl compounds stripped from wax and an odor panel's evaluation of the same wax.

Let Glycols Help Inhibit Hydrate Formation 125
By J. L. Arnold and R. L. Pearce
Here's how to select the right glycol, injection rate, and concentration to get good inhibition in low-temperature units. Also included are pointers on how to prevent or correct common operating troubles. Part 2 of two parts.

Canadian Oil's "Compact" Model Refinery 141
The Alberta plant features fully integrated process units, electronically controlled and air cooled, and flexibility in feed stocks.

Pipelining

Self-adjusting Pig Cleans Dual-Size Line 148
Device has proved effective in 18 months of service in 16 and 20-in. line.

Compact Paint Cart Saves Time, Cuts Wear 149

THE OIL AND GAS JOURNAL **Newsletter**

July 3, 1961

Significant this week

Go-slow policy in development of Alberta natural-gas liquids markets has been advised.

Alberta Oil and Gas Conservation Board told provincial Government this is preferable to big, sudden exports of natural-gas liquids to Chicago.

Board took this tack in denying proposed Chicago export project of Pembina Pipe Line and Standard Oil of Indiana.

Behind the action: Belief that gradual development of existing Canadian and U. S. markets is required if Canada is to keep its exemption from American import controls. Loss of exemption could smash new Canadian oil policy (p. 73).

It's going to take more than ordinary negotiations to end the bitter deadlock in the National Maritime Union dispute.

Reason: Issues transcend routine collective bargaining. They involve such questions as future of the U. S. Merchant Marine.

Congress may have to deal with that angle.

Meanwhile, both sides in the dispute are bogged down over the thorny problem of bargaining rights on American-owned "foreign-flag" ships.

It's estimated that tanker operators are losing $440,000 a day in the shipping tieup (p. 78).

Problem of bacteria in jet fuel is causing new concern.

Troubles like filter fouling and corrosion in wing tanks and fuel systems have become more pronounced since jets took over as major means of air transport.

Basic question researchers are trying to solve: Do microbes cause corrosion, or does corrosion spawn the bugs? (p. 82).

Tennessee Gas Transmission has wound up a deal to buy more than half a trillion cubic feet of in-place reserves.

Company is paying $97 million to CATCO group for the reserves off Louisiana. Deal follows TGT's purchase of a trillion cubic feet of gas from Pan American (p. 81).

Threat to natural gas is seen in federal Government's ideas about subsidizing coal and corn as petrochem materials.

Industry leader has warned American Association of Petroleum Landmen that serious consideration is being given to such a move (p. 90).

A $2 pipe-corrosion detector is saving thousands of dollars for Shell.

The device, used in water-flood projects, consists of spark plug, rubber band, and steel ribbon. Triggered by break in electrical circuit through corrosion, ingenious "watchdog" tells when more inhibitor is needed in the stream (p. 137).

Another big railroad wants to move into pipelining.

Pennsylvania Railroad is proposing 80-mile products line between Baltimore and Washington, D. C. Customers would be airports and military bases around national capital (p. 91).

Tubular-goods prices to oil companies have been cut for the first time in 20 years.

Aiming at better service, mills agreed to give jobbers an extra 4% discount for holding shipments in inventory under a new buying plan.

But one supplier passed the discount on to the customer, and other suppliers followed. This left the jobbers out in the cold and amounted to a price cut for oil companies (p. 89).

First test in Canada's Arctic islands may be drilled before year is out.

Canadians have high hopes of finding "big oil" in the remote area. Seventeen companies are taking part in this first million-dollar wildcat.

Exploration convoy sails from Quebec in mid-July (p. 76).

Elsewhere around the world:

Tanker terminal near entrance to Persian Gulf is planned by Petroleum Development, now working Murban offshore field.

This will give Murban oil a transportation advantage over tanker loadings farther up the gulf (p. 101).

Iraq Petroleum is trying hard to get Premier Abdul Karim Kassim to resume the oil talks he broke off in April.

Future of the company and Iraq's own future as a leading producer could be at stake in the negotiations (p. 97).

Although the Iraqi premier's claim to Kuwait stirred up a political hornet's nest, Arab experts see no military moves.

Their feeling is that Saudi Arabia would join United Arab Republic in supporting the little shaikhdom if Kassim tried to use force (p. 98).

Crude production abroad has fallen off.

April saw sharp drop in Venezuela and Kuwait.

Long growth spirals in Algeria and Argentina came to an end. And French Saharan output showed first monthly decline since Hassi Messaoud pipeline began taking crude (p. 102).

News in the making

Texas guessing game revolves around question of who'll replace the late Olin Culberson on the Railroad Commission.

More than a dozen names figure in speculation. Among them: Arthur Barbeck, commission's chief engineer; French Robertson, Abilene independent; Ben Ramsey, state lieutenant governor; Judge Charles Langford, commission's chief engineer in late 1930's; J. J. O'Brien, oil operator and ex-TIPRO president; Earl Rudder, president of Texas A & M College; Jerry Sadler, state land commissioner.

Appointment will be made by governor.

Monsanto Chemical will put a petrochemical plant on open-loop computer control.

Company has bought four digital computers for on-line computation at its Chocolate Bayou, Tex., plant. Minneapolis-Honeywell Regulator is the contractor and will furnish electronic instruments.

Appointment of L. J. O'Connor, Jr., to Federal Power Commission may have been made by the time you read this.

If not, chances of the oil imports administrator will dwindle with each passing day. Reason: O'Connor has long been under consideration for the FPC post, so there's no apparent reason for delay if he's to be the choice.

Another important wildcat will be spudded in Alaska soon.

Standard of California is building roads to its drill site along the southern coast in the Icy Bay area. Test will be the first in a 247,000-acre development contract granted to Socal recently.

There'll be new interest in moving U. S. natural-gas liquids to Chicago, now that Canadian line is ruled out.

Mounting volume, moving with crude, will come from the Rockies, Mid-Continent, and Gulf Coast through existing lines.

You can expect refinery capacity in western Canada to stabilize for some time to come.

Refiners there are making room for increasing amounts of natural-gas liquids, at the expense of crude. Except for downstream processing units to handle these light fractions, little in the way of new construction is in sight.

Look for renewed tax assault on gas pipelines in Texas.

Gov. Price Daniel is beating the drums for a gas-line tax even harder as state legislature gets ready to reconvene in special session next week.

Daniel has virtually promised to veto any sales-tax bill not accompanied by new taxes on gas lines.

Market memo

July 3, 1961

Gulf Coast opinion practically **rules out further boosts** in area gasoline prices during early part of July.

Late last week there had been no reports of any spot sales to test higher prices that were **sparked by the maritime strike.** Current posting for 92-octane regular is 11 cents.

Weekly stock figures show **extra gasoline** had been shipped from Gulf Coast to East Coast ahead of the maritime dispute. Despite increase in seasonal demand for gasoline, East Coast **gasoline stocks rose slightly** between May 19 and June 16.

Little activity has been reported in Mississippi River markets.

Increase in Gulf Coast posting for gasoline—plus easing off of spot Group 3 price at 12.25 cents—limits area that can be served from Mississippi barge shipments.

Mid-river gasoline is available at 0.25 cent off Gulf Coast postings. No. 2 fuel prices range from one-quarter to one-eighth off Gulf Coast quotations.

Regular gasoline is obtainable on the Group 3 spot market at 12.25 cents, with formal quotations at 12.50. There were unconfirmed reports last week that some gasoline had been sold for 12 cents. These reports came from areas that could be served from terminals on the northern third of the Great Lakes Pipe Line.

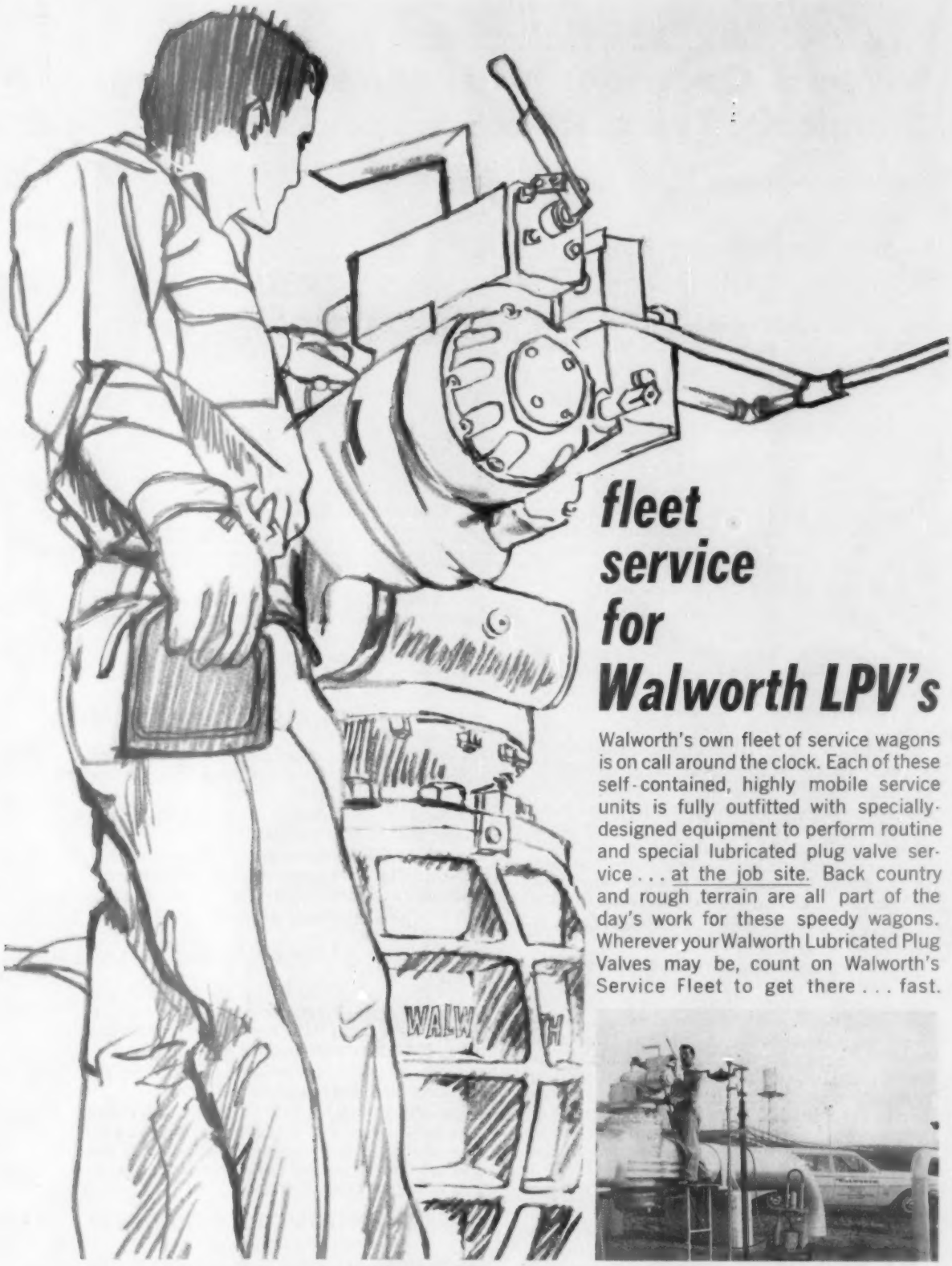
They were at it again in Charlotte, N. C., last week.

After gasoline prices reached such a ridiculous point that some suppliers were paying dealers to take their product, levels returned to almost normal. Then the pattern that began in May was resumed. **Prices started dropping**—and at midweek were 8.5 cents per gallon for regular at the dealer tankwagon level. This is about half the so-called normal price.

Retail prices generally were 23.9 cents, including 11 cents tax. Some majors were holding at 25.9. If the pattern continues, a **further drop** will come and the price war will keep raging.

Marketing notes: High inventory level of propane has lowered the summer price. Net contract prices, after discount and summer-fill allowance, range from 2.5 to 3 cents a gallon. For straight spot sale, material probably could be found at 2 cents or a little less.

Planned merger of Ingram Oil & Refining into Murphy Corp. is a move by latter company to **beef up its marketing position** in southeastern states. Included in the $16.5-million deal: Ingram's New Orleans refinery with throughput capacity of 20,000 bbl. daily. Ingram also operates seven products terminals and markets through 212 outlets (p. 84).



fleet service for Walworth LPV's

Walworth's own fleet of service wagons is on call around the clock. Each of these self-contained, highly mobile service units is fully outfitted with specially-designed equipment to perform routine and special lubricated plug valve service . . . at the job site. Back country and rough terrain are all part of the day's work for these speedy wagons. Wherever your Walworth Lubricated Plug Valves may be, count on Walworth's Service Fleet to get there . . . fast.

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A Visco® PRODUCT MANAGER
Answers Questions on Emulsion-Breaking Chemicals, Tests, Reactions and Costs

Ordinary Problems in Emulsion Breaking Often Require Extraordinary Field Experience and Know-How

Despite the familiarity most oil production men have with emulsions and emulsion-breaking, basic questions about the subject are frequently asked. Here are some of these questions, with answers based on Visco's vast cumulative experience in the field and laboratory.

Question: What causes emulsions?

Answer: Turbulence, or pressure, or both, where oil and water are present. Bottom-hole pressures, pumping, and flow turbulence in tubing and surface piping tend to create water-oil emulsions in varying degrees.

Question: How do emulsion breakers work?

Answer: Probably the most commonly-expressed theory of demulsification is that the emulsion-breaker chemical lowers the surface tension of either the water or the oil, or both. Lowered surface tension enables the water and oil globules to separate out of emulsion and coalesce, with the water settling out.

Question: How are emulsion breakers chosen?

Answer: The type and amount of emulsion breaker needed to resolve an emulsion must be determined by experimentation with small quantities. This experimenting is commonly called bottle-testing. A number of emulsion-breaker formulas may be tried, and the one chosen by Visco field men is the formula which will produce clean oil at the lowest cost.

Question: How much emulsion-breaker chemical is needed?

Answer: Treating ratios vary from 50 barrels of crude oil per gallon of chemical in less efficient batch operating procedures to as much as 2,500 barrels of crude per gallon of chemical in efficient continuous-treating systems. Chemical formulation quality often makes a big difference in the amount necessary to treat a given quantity of emulsion to produce clean oil. This is the reason that the cheapest emulsion-breaker, per gallon, is not necessarily lowest in cost for good treating results. Visco men treat to get low-cost pipeline oil.

Question: Is heat always necessary for breaking emulsions?

Answer: No. Usually, Visco emulsion-breakers can be recommended which will produce results with much less heat—or eliminate the need for heating entirely.

Question: What advantages are there in reducing heat?

Jack P. Thomas, Visco Production Chemicals Product Manager, checks progress of a new emulsion breaker under development in Visco Laboratories. Thomas' wide experience in both field and laboratory enables him to answer questions on emulsion breaking with authority.

Answer: Reducing or eliminating heat usually produces a rise in the gravity of the oil. This not only brings better prices per barrel, but also, by saving light ends, a larger volume of oil is produced. Low- or no-heat emulsion-breaking also saves on fuel costs.

Question: Can oil losses in carryover with the water be eliminated?

Answer: Yes. Oil lost in carryover indicates need for better emulsion breaking. Your Visco Representative can eliminate carryover.

Question: Can Visco emulsion breakers reduce or eliminate tank bottom build-up?

Answer: Yes. The right chemicals, recommended by your Visco Representative, will prevent build-up of tank bottoms—And he can also tell you how to treat existing bottoms to get rid of them without waste.

Question: Do Visco emulsion breakers harm refinery catalysts?

Answer: No. Refinery catalysts are generally poisoned by organic halides and heavy metals. Visco does not use these materials in the manufacture of any emulsion-breaker chemicals.

Question: How can maximum emulsion-breaker efficiency/economy ratios be determined?

Answer: The simplest, fastest way to determine how to get the best results at the lowest possible cost is to call your Visco Representative and ask for tests and recommendations. Call him today for prompt action.

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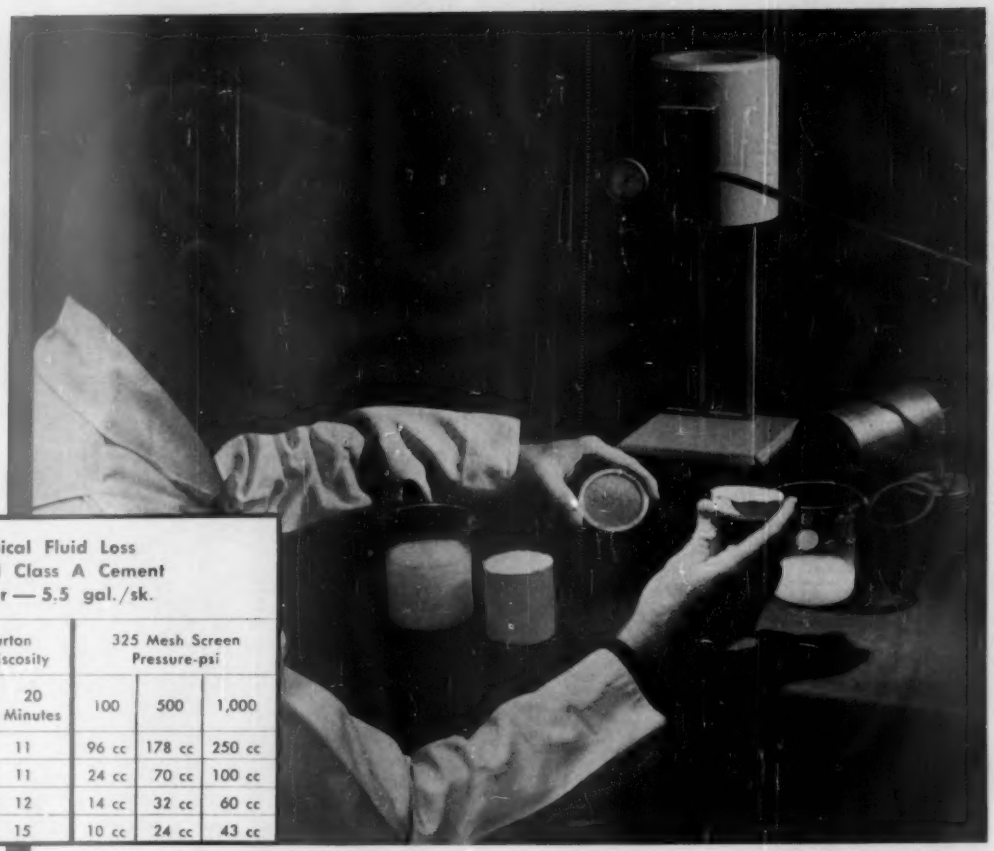

Typical Fluid Loss in API Class A Cement
Water — 5.5 gal./sk.

Per Cent Halad-9	Halliburton Slurry Viscosity		325 Mesh Screen Pressure-psi		
	Initial	20 Minutes	100	500	1,000
0.6	4	11	96 cc	178 cc	250 cc
0.8	4	11	24 cc	70 cc	100 cc
1.0	5	12	14 cc	32 cc	60 cc
1.2	10	15	10 cc	24 cc	43 cc

New Discovery Makes It Possible To

CONTROL CEMENTING FLUID LOSS WITH ALL CEMENTS, ALL ADDITIVES

Halad-9, Halliburton's new cement additive discovery, is another big step forward in controlling fluid loss in primary and squeeze cementing operations. Ability of Halad-9 to control fluid loss is illustrated above by comparison of the controlled filter cake build-up (in hand) obtained with one per cent Halad-9, and the dehydrated cement sample on the left, after both were subjected to the same API fluid-loss test.

Halliburton research tests show Halad-9 additive to be completely compatible with all API Class A, E, and Pozmix Cements. Compatibility also exists with cement additives such as bentonite, accelerators, retarders, and lost circulation materials.

EFFECTIVE ACTION — Usually 0.8 to 1.1 per cent of Halad-9 is adequate for squeeze cementing.

HEAT STABILITY — The low percentages of Halad-9 required for most slurries show excellent stability at bottom hole temperatures exceeding 200°F. The slight retarding characteristics of Halad-9 can be used to good advantage in hesitation squeeze cementing techniques — or can be modified if desired by an accelerator or additional retarder as well conditions require.

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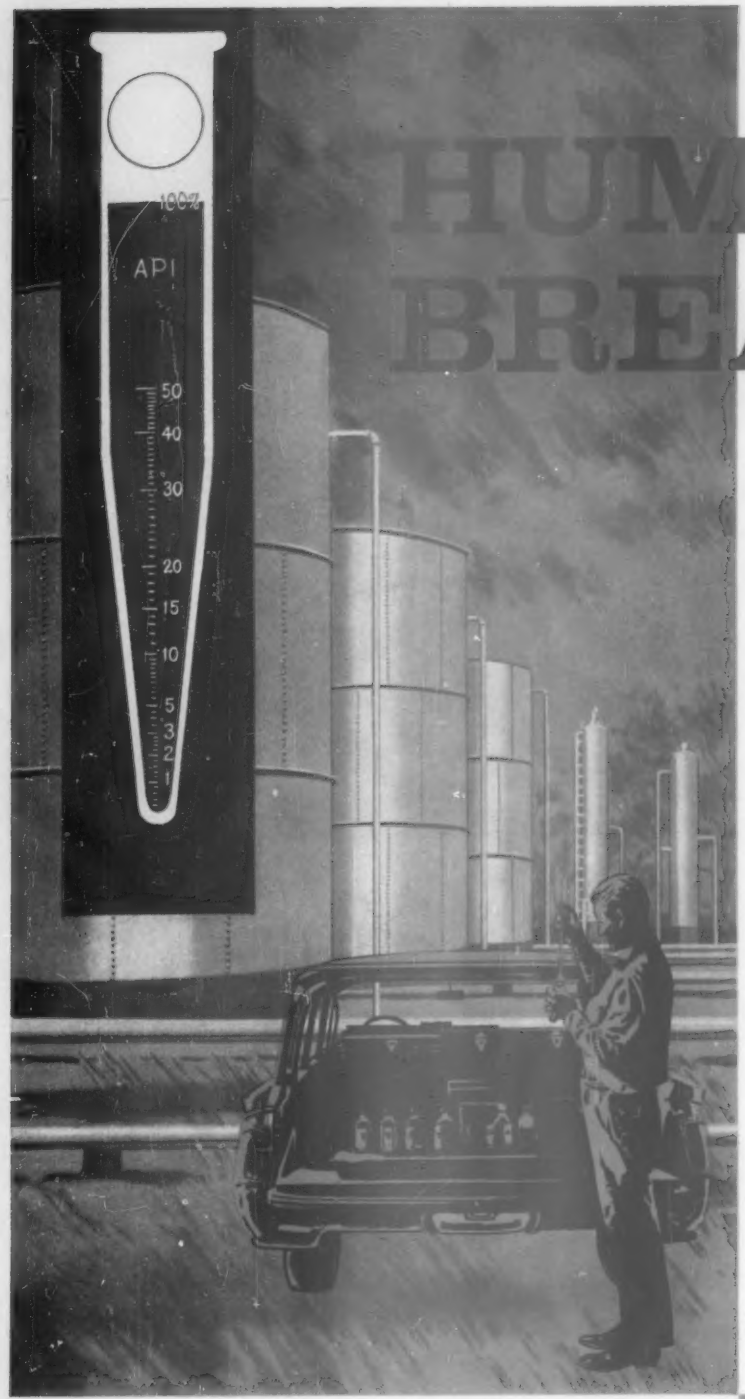

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Gets maximum pipeline oil from any well

To get the greatest amount of salable oil from your production, there are many *different* Humble BREAXIT emulsion breakers . . . each designed for efficient treatment of a different concentration of water in the oil. Result?

Users of these specialized BREAXIT formulations report important savings through lowered treating costs and increased recovery.

Find out which BREAXIT will be most profitable in your production. Ask Humble to have its engineers make on-the-lease tests of your emulsions. For more information about BREAXIT, see your Humble salesman, or contact Humble Oil & Refining Company, Houston, Texas.

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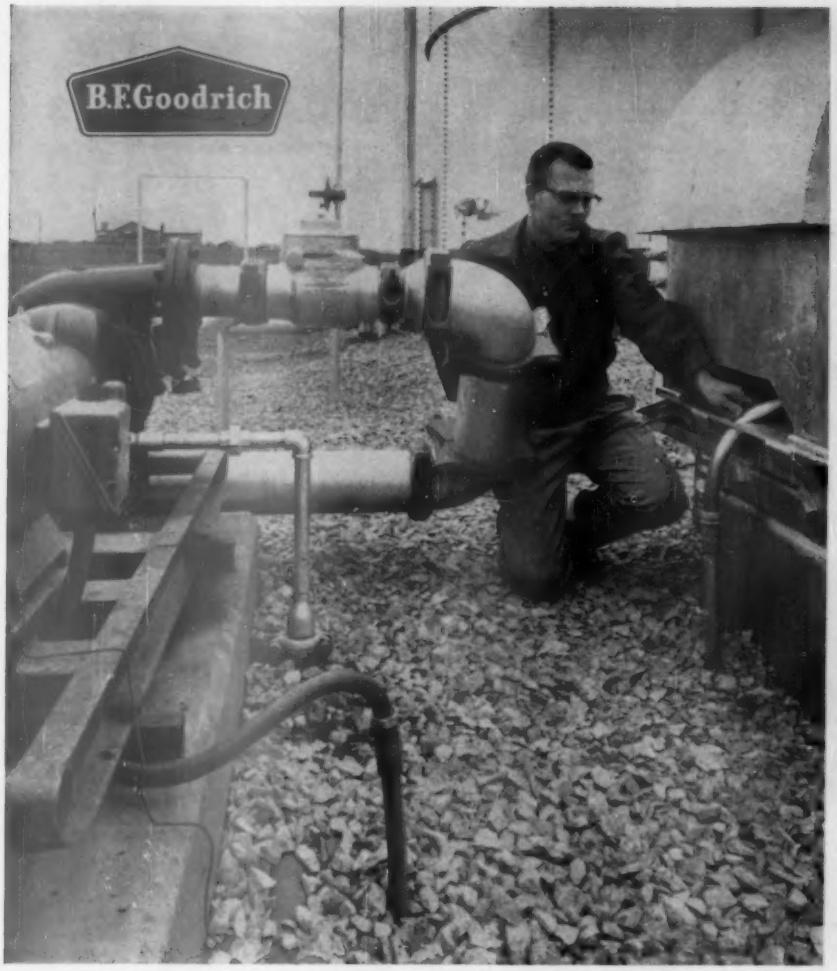

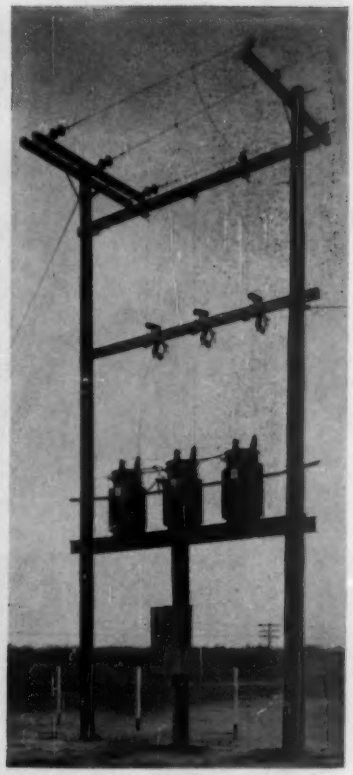

Lloyd Thomas Electrical, of Austin, Texas, installed the rigid conduit shown here at the Pierce Lease of Cities Service Petroleum Company, about five miles south of Electra, Texas. The Kraloy Rigid PVC Conduit and fittings are manufactured by Kraloy/Chemtrol Co., Electrical Conduit Division, Santa Ana, California, using rigid Geon supplied by B.F.Goodrich Chemical Company.

Electrical contractor reports:

Conduit of rigid Geon solves salt water corrosion problem in flooding operations

Secondary recovery operations in Texas oil fields involve the injection of salt water under pressure into oil formations. This salt water can cause a real corrosion problem with metallic conduit, resulting in short circuits and costly shutdowns. The solution: Conduit made of rigid Geon vinyl.

"Using metal conduit, an installation rarely lasts more than six months," the contractor says. "In fact, we've had instances of short circuits in as short a time as six weeks. However, it is more than a year since we made our first installation of rigid Geon and there has been no need for repair or replacement."

Rigid Geon not only resists most causes of corrosion, it gives conduit impact resistance and tensile strength. It is lightweight, easy to install. Crews like to work with it.

Here's another way rigid Geon is helping to solve application problems — making possible new products and new markets. For more information, write Department NL-4, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

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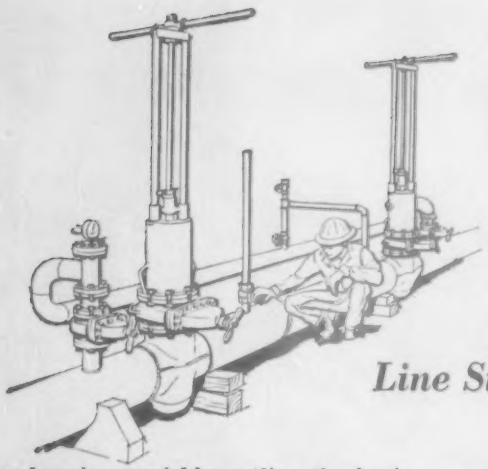
Geon VINYLS

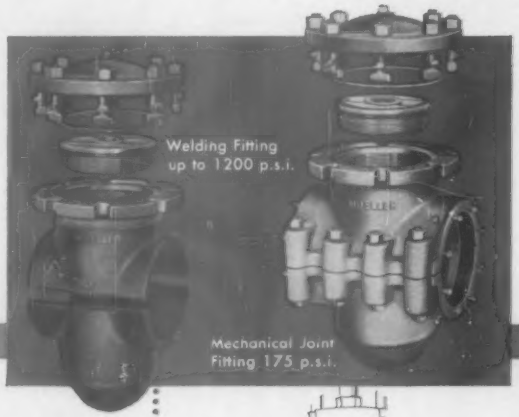


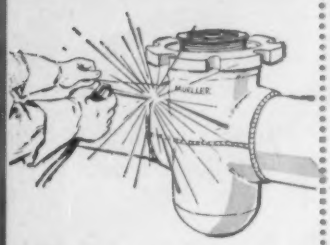
stop-off high pressure lines where there are no control valves!

here's how—with MUELLER® Line Stopper Fittings and Equipment

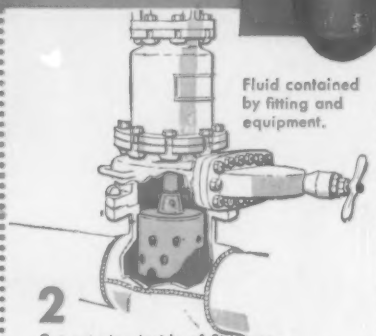
These drawings quickly outline the basic procedure used in stopping-off a line under high pressure with Mueller Line Stopper Fittings and Equipment. Line Stoppers may be used at any point on any type of line. Once installed, the fittings may be re-used for future stop-offs.

Only the major steps are shown here. Write direct for the complete story and specifications.



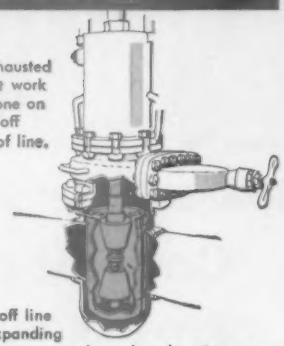


1 Weld fitting to line.



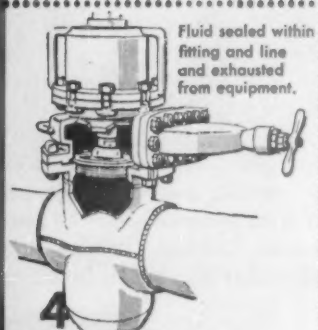
Fluid contained by fitting and equipment.

2 Cut out pipe inside of fitting to accommodate cylindrical stopper.



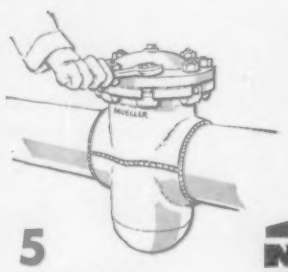
Fluid exhausted to permit work to be done on stopped-off portion of line.

3 Stop-off line by expanding neoprene-covered, steel wedge stopper.



Fluid sealed within fitting and line and exhausted from equipment.

4 Insert completion plug into top of fitting.



5 Bolt completion cap in place on fitting.

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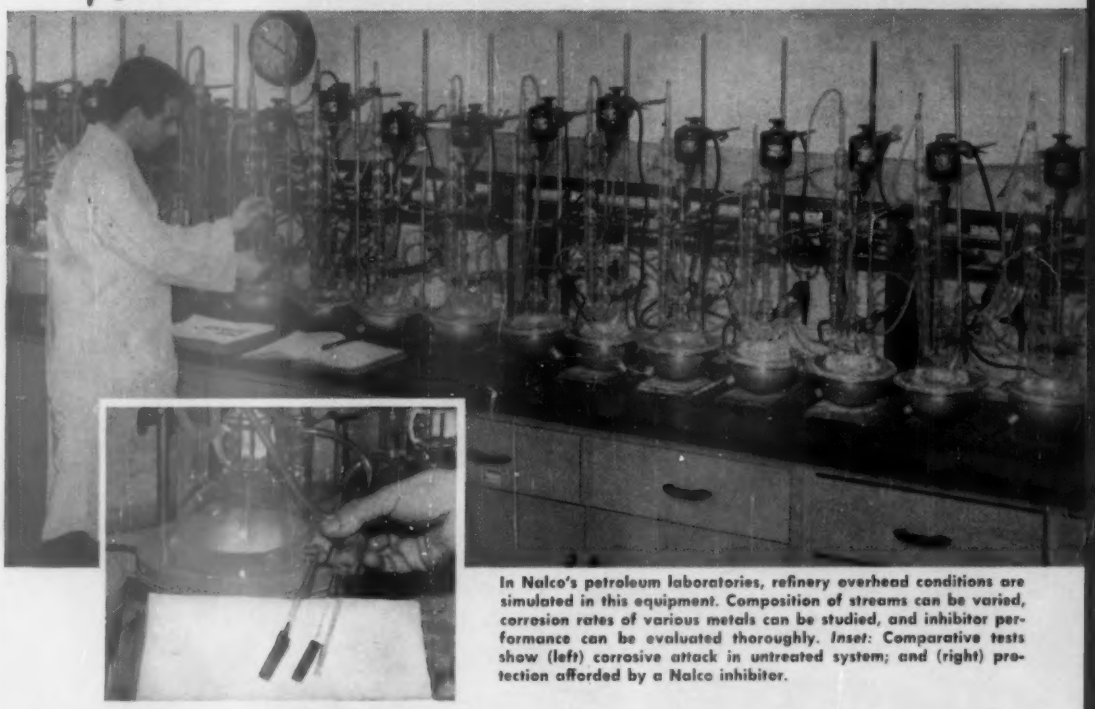
Nalco® CORROSION CONTROL PROGRAMS



In Nalco's petroleum laboratories, refinery overhead conditions are simulated in this equipment. Composition of streams can be varied, corrosion rates of various metals can be studied, and inhibitor performance can be evaluated thoroughly. *Inset:* Comparative tests show (left) corrosive attack in untreated system; and (right) protection afforded by a Nalco inhibiter.

COMBINE:

EFFECTIVE INHIBITORS

COMPLETE TECHNICAL KNOW-HOW

FAST, EFFICIENT SERVICE

Nalco inhibitors give you maximum protection at minimum cost . . . help you get many extra years of service out of every piece of equipment. They allow you to maintain maximum protection despite variations in feedstocks and wide pH fluctuations. Throughout your entire system the rapid film-forming action and high temperature stability of Nalco inhibitors will help you gain and keep the finest corrosion control.

Research on petroleum industry corrosion problems is a continuous study project at Nalco. This broad program of basic research into theories of corrosion inhibition and practical application studies makes Nalco's inhibitors highly effective and extremely versatile. The technical excellence of Nalco service is the result of extensive field experience and continuous laboratory research on corrosion control. Improve your operating picture and reduce maintenance costs with proven inhibitors and better methods of corrosion control.

There are Nalco Representatives in every petroleum processing area of the country, and near most major refining centers of the world—ready to respond immediately when you need assistance. Let them help you determine the extent of your corrosion problems, recommend inhibitors, advise on application techniques, set up chemical control programs, and help evaluate results. Call your Nalco Representative for action, or write for detailed data in free File G-3.

for BEST CORROSION CONTROL RESULTS

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Subsidiaries in England, Italy, Mexico, Spain, Venezuela and West Germany. In Canada: Alchem Limited, Burlington, Ont.

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3 heads are better than 1 . . .

Often a utility electric power company engineer enters into a decision with one or more oil company engineers . . . effecting the economy of operation. This assistance is available anytime to oil producers, pipeline personnel or refinery engineers. As a matter of interest the triple pumper in the photograph pumps simultaneously from three producing zones.

Petroleum Electric Power Association
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Utility Electric Power saves money, manpower, maintenance and serves you better automatically

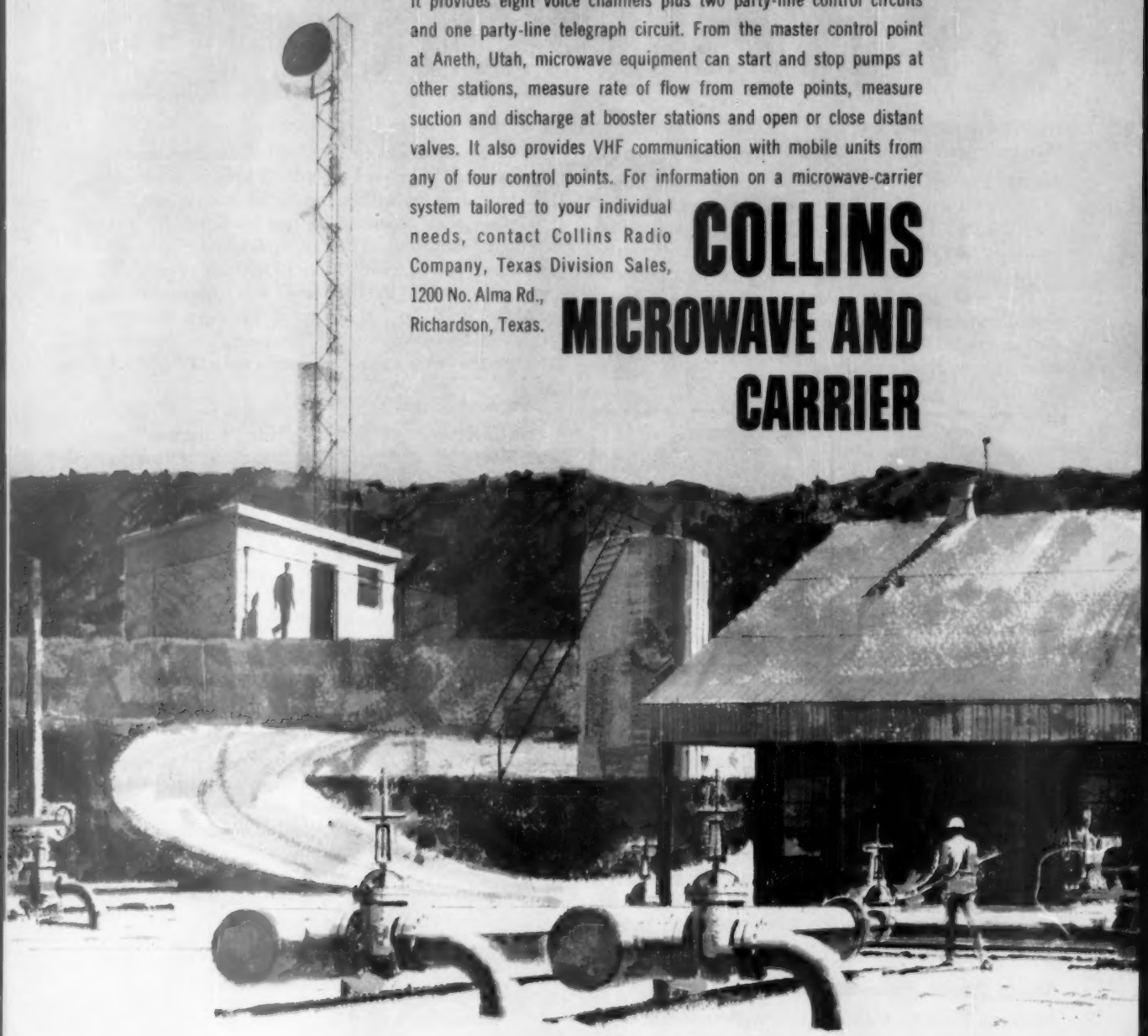
A list of P.E.P.A. members will be furnished on request

TEXAS-NEW MEXICO PIPE LINE COMPANY

installs microwave for control and monitoring of 513-mile pipeline...

New 14-hop Collins microwave-carrier system extends from pipeline offices in Blanding, Utah, to terminal at Mesa, New Mexico. Initially, it provides eight voice channels plus two party-line control circuits and one party-line telegraph circuit. From the master control point at Aneth, Utah, microwave equipment can start and stop pumps at other stations, measure rate of flow from remote points, measure suction and discharge at booster stations and open or close distant valves. It also provides VHF communication with mobile units from any of four control points. For information on a microwave-carrier system tailored to your individual needs, contact Collins Radio Company, Texas Division Sales, 1200 No. Alma Rd., Richardson, Texas.

COLLINS MICROWAVE AND CARRIER



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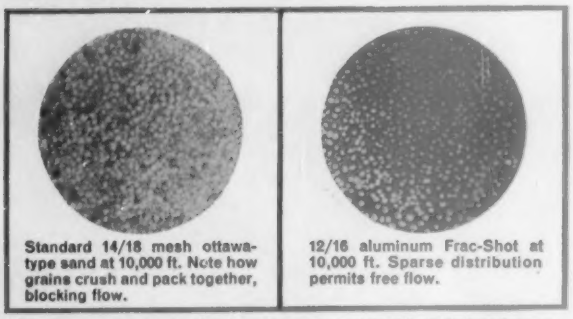
New proppant boosts well production!

REYNOLDS ALUMINUM FRAC-SHOT™

Aluminum Shot—New Propping Agent

Reynolds Frac-Shot is a new propping agent which makes well fracturing more effective, more profitable. Since its introduction, Frac-Shot has proved itself in hundreds of wells, boosting productivity many times over conventional fracturing methods.

The new propping agent is aluminum "shot"—malleable pellets of aluminum, carefully sized and processed for well servicing. It is available from all major service companies.



Standard 14/18 mesh ottawa-type sand at 10,000 ft. Note how grains crush and pack together, blocking flow.

12/16 aluminum Frac-Shot at 10,000 ft. Sparse distribution permits free flow.

Photos courtesy Pan American Petroleum Corporation and The Atlantic Refining Company.

Better Flow from Fractures

Two qualities make Frac-Shot a more effective propping agent than conventional materials: (1) It doesn't crush and "pack" the fracture, and its sparse distribution permits more flow. (2) The Frac-Shot pellets are malleable, deforming slightly under pressure to provide even better fracture support.

Where sand alone may crush and block the flow in a fracture—or be pressed into the fracture walls, Frac-Shot pellets keep fractures open and permit fluids to flow freely.

Tests Prove Frac-Shot

In Kern County, California, a well that had been previously fractured with walnut shells at about 12,150 feet was producing 21 b/d net. After treatment with approximately 3,200 lbs. of Frac-Shot at about the same depth, the well showed a steady increase until it leveled off at 182 b/d. It is expected that production will be sustained at this level.

In another recent field test at 7,050 ft. in the Wilcox formation in Texas, 4,500 lbs. of Frac-Shot was used as a "tail-in" after 13,000 lbs. of sand. The gas production in this well was increased from 130,000 c.f.d. to 700,000 c.f.d. Previous history in this field indicated that conventional fracturing techniques would have produced only 260,000 c.f.d.

Use and Cost

Frac-Shot is used primarily for "tailing-in" conventional fracturing treatments. Sand is used first, and then Frac-Shot is added to occupy 25% of the radius nearest the well bore.

Although Frac-Shot costs somewhat more than sand, the additional expense is quickly offset by the great increase in production of fractured wells. And, on very deep wells, Frac-Shot may actually cost less than an all-sand fracture, due to the great amount of sand required.

Get Full Details

Frac-Shot is available from all major service companies. For full imformation and free brochure on Frac-Shot, contact the people who know aluminum *and* aluminum for petroleum use—your local Reynolds office. Or write: *Reynolds Metals Company, P. O. Box 2346-CR, Richmond 18, Virginia.*

Watch Reynolds TV show "Harrigan & Son", Fridays—ABC-TV.

The "OILWELL" string...

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STORES

99 years of know-how show in the "Oilwell" products and services that come to you through our field stores and pump shops, manufacturing plants, warehouses and offices serving the oil fields everywhere. When you buy from "Oilwell", you buy much more than a piece of equipment. You buy a *function* . . . a *means* of more profitable operation. Turn the page for examples of why the "Oilwell" string—*Products, Services and Stores*—means "plus value" in every piece of "Oilwell" equipment you buy.

USS

Oil Well Supply
Division of
United States Steel

Executive and Export Offices: Dallas, Texas

The "OILWELL" string . . . PRODUCTS SERVICES STORES

Every sucker rod a stretcher case?

We can't resist saying "stretcher case" because it refers to an "Oilwell" exclusive in sucker rod manufacture. Only "Oilwell" *stretch-straightens* rods (grades "Y," "T" and "O"), while at tempering heat. Why? To avoid introducing internal stresses that can be caused by cold straightening; and to cull out rods with surface defects (which show up most clearly when the rod is hot stretched).

Hot stretch-straightening is only one of the many reasons why "Oilwell" sucker rods are the most dependable you can buy. And you can choose from five different grades of "Oilwell" rods tailored for specific well conditions:

Grade "Y" for corrosive-inhibited deep wells. These boron-containing rods are "shot peened" as well as liquid quenched, over their entire length. They have both toughness and strength to give maximum service in corrosion-inhibited wells or wells having mild sulphuric brines.

Grade "T" for combatting embrittlement due to sour environment. Liquid-quenching and tempering of this low carbon, nickel content rod increases its fatigue resistance and improves service life in sour wells.

Grade "O" A new "Oilwell" Sucker Rod made of boron alloy steel. Liquid-quenching and tempering imparts exceptional resistance to fatigue under heavy loads. It also performs well under hydrogen embrittlement conditions where inhibitors are used to reduce pitting action.

Grade "L" for carbon dioxide corrosive conditions and medium-to-heavy non-corrosive wells. Made of fully normalized and tempered special nickel-chromium alloy steel, these rods have a "pearlite" grain structure having excellent resistance to carbon dioxide corrosion. Their long runs contribute to a big reduction in pulling costs.

Grade "N" for non-corrosive or inhibited wells. After bar stock has been roll-straightened and rod ends have been formed, these API-"C" rods are normalized to obtain optimum strength, toughness and resistance to shock and fatigue. Will give superior performance in non-corrosive or inhibited wells.

Any well can be pumped economically with one of the five "Oilwell" sucker rods described above. If you want more information, we suggest that you talk to the manager of the "Oilwell" store in your area.

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Pump repair where you need it

When you're faced with the repair or reconditioning of any subsurface pump, just get it to the nearest "Oilwell" pump shop. These shops, located for the convenience of our customers, carry complete stocks of quality parts, are equipped with modern tools, and are staffed by experienced pump men. You will find "Oilwell" subsurface pump maintenance service completely satisfying . . . in the quality of the work we do . . . and in its surprisingly reasonable cost.

Where there's oil — there's "Oilwell"

Every dot on the map represents an "Oilwell" store. There's one near practically every important drilling, production, pipeline or processing operation. One is probably within an hour's drive of you now. And there's always stock not more than a night away! The managers and personnel of these conveniently located "Oilwell" supply stores give you not only fast service, but they can usually help with out-of-the-ordinary problems.

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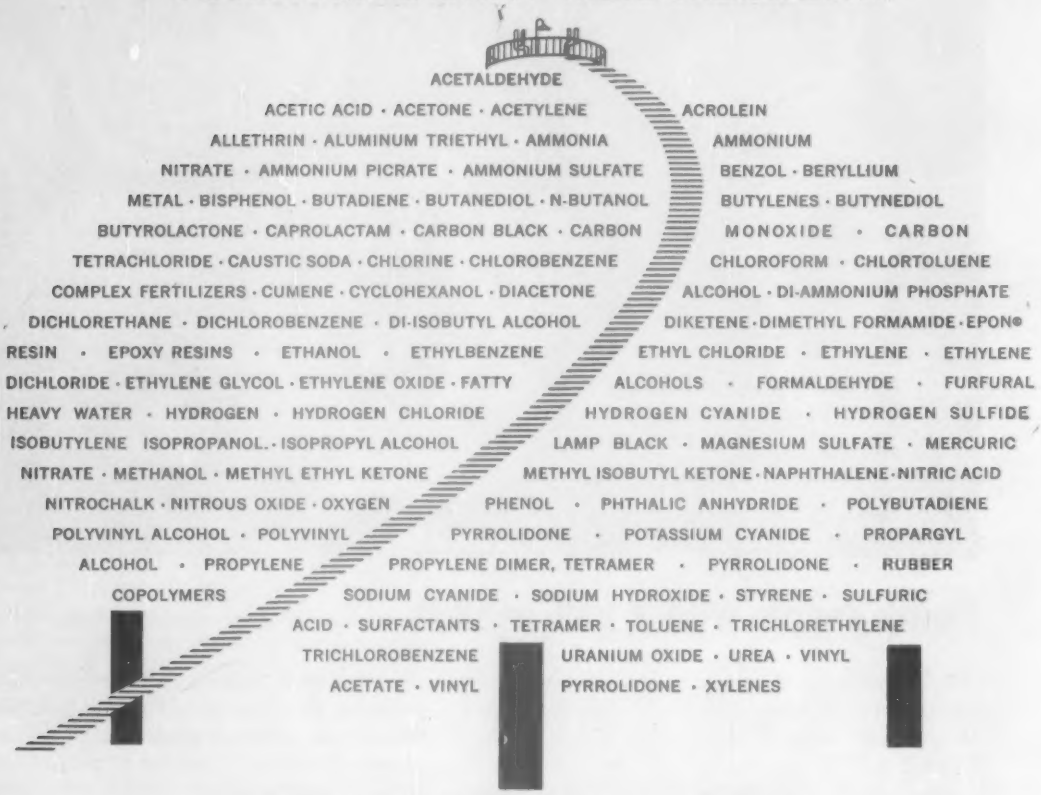
IF YOU'RE PLANNING TO BUILD A NEW PLANT TO MAKE ANY OF THESE CHEMICALS...



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ALCOHOL · PROPYLENE · PROPYLENE DIMER, TETRAMER · PYRROLIDONE · RUBBER
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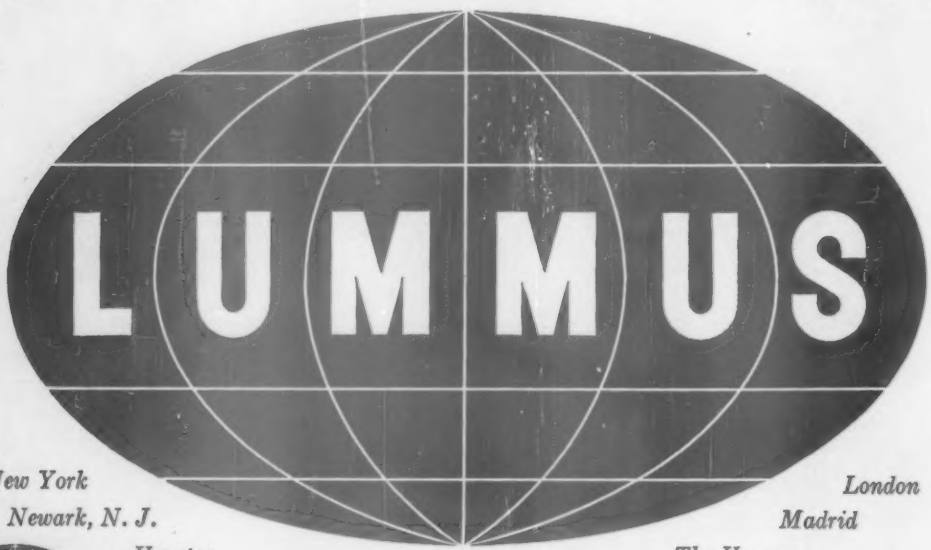

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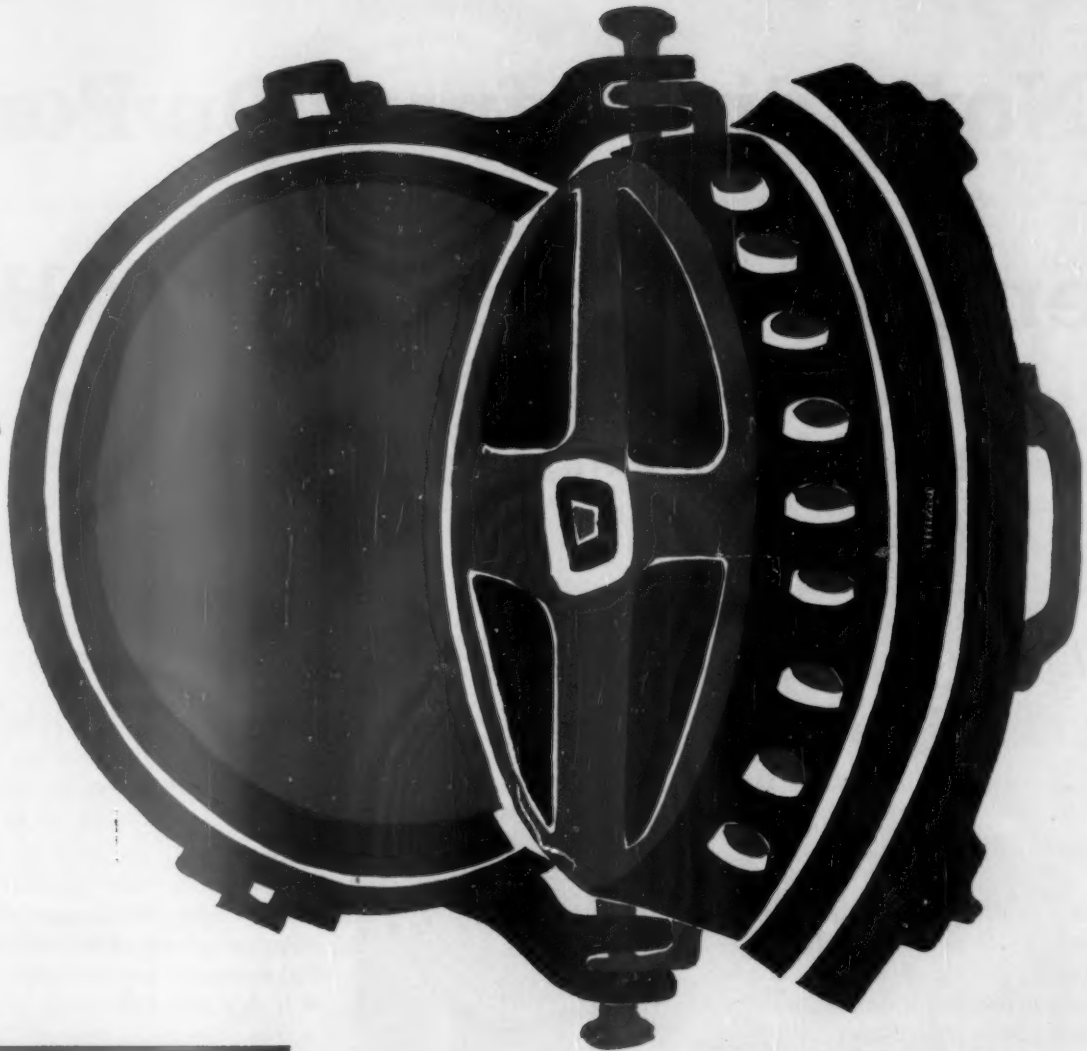

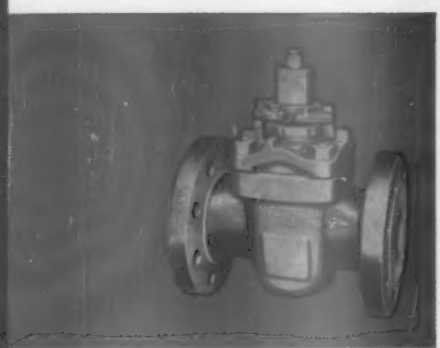

seals tight: Let's get basic: The prime function of a valve is to shut off a line. And Rockwell-Nordstrom valves do this job better than any other valve on the market. They live longer, too, saving you money every year in valve replacement. The cost? No more than ordinary valves. Write for complete information.

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Now...direct from Du Pont.

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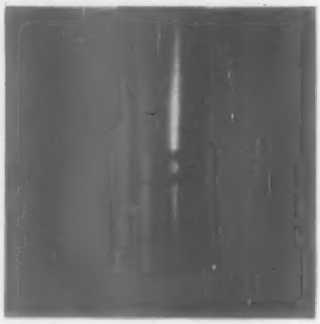
Performance thoroughly field-tested in flow lines . . . water flood lines . . . salt-water disposal lines

Lower installation and maintenance costs provide substantial savings where corrosion is a problem



INTEGRAL JOINT

Out of Du Pont research comes a completely new kind of line pipe—tough, strong, corrosion-resistant, easy to install and maintain. Du Pont **DELRIN** ACETAL RESIN PIPE was developed specifically for use in flow lines, gathering lines, water flood lines and salt-water disposal lines. It offers a combination of properties never before available in line pipe—for the simple reason that it is made of a new engineering material, **DELRIN** acetal resin. This material was designed to provide performance and cost advantages in many applications once reserved for metals.

Here's why **DELRIN** PIPE is uniquely suited for the oil-field applications listed above—and why it can afford you substantial savings in installed-pipe costs:

- It is strong and tough . . . with ample reserves of strength to provide long-term service under the conditions actually encountered in the field. It is even stronger under pressure-surging conditions than under steady peak pressure. It remains strong and tough at temperatures up to 160°F. and beyond, and in the presence of crude oil.
- It is corrosion-resistant, both internally and externally . . . functions equally well buried or laid on top of the ground.

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BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

Manufactured, sold, serviced and backed by Du Pont

. a new kind of line pipe

for oil-field use

• It resists paraffin build-up with all paraffin-based crudes so far encountered.* And because of its extremely smooth internal surface, friction losses are unusually low.

• It is easily joined by heat fusion . . . ready to operate at full line pressure within a minute. Under normal field conditions, 25 seconds or less are required to heat and make the integral joint.

• It provides lower shipping costs, easier handling, lower installation costs. These advantages are a function of its light weight and ease of joining.

These are the facts. They have been established by more than five years of intensive laboratory testing by Du Pont, and by over two years of field testing in various oil-producing areas of the country, conducted by major oil companies.

Du Pont invites you to examine the **DELRIN** PIPE verifying data in detail. You may obtain complete engineering specifications, plus detailed anaylsis of various field installations, by mailing the coupon. Your request will bring full information on prices and availability, and the location of Du Pont technical representatives serving the oil industry.

**See detailed reports on test installations, available by mailing coupon below.*

Using a simple heat joining tool, this crew is completing the installation of a length of pipe in one of the many installations that have proved the performance of **DELRIN** PIPE in the field over the last two years.

Mail this coupon for information that can help you save money on your next pipe installation...

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Dept. OG-7, Room 2507P, Nemours Building
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Please send me complete information on **DELRIN** PIPE for oil-field installations.

Name_____

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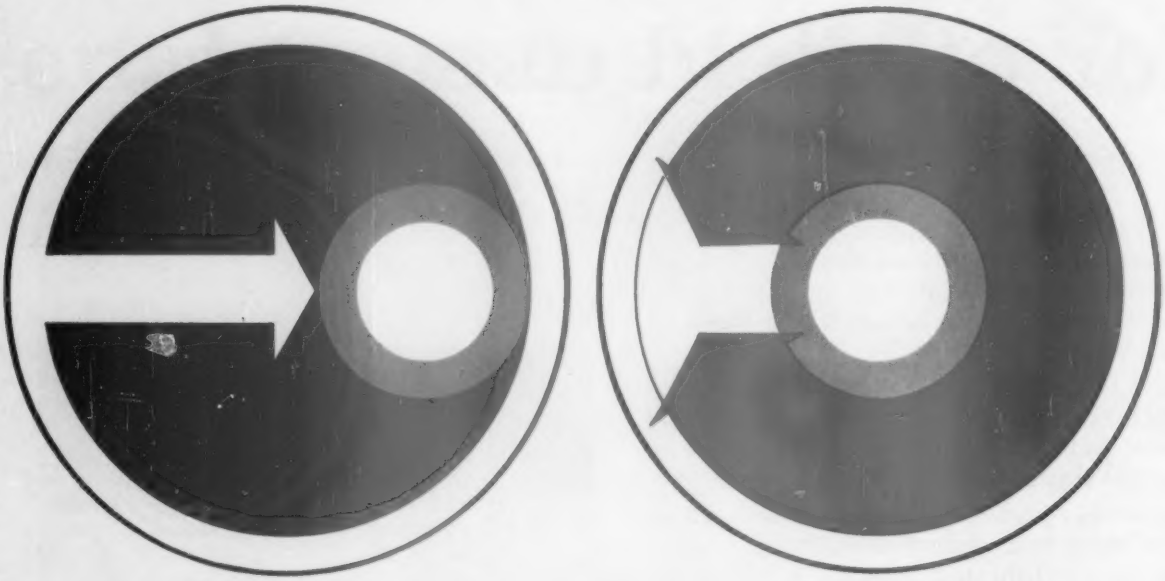
NEW PIPE-LAX IS THE WORLD'S BEST STUCK PIPE INSURANCE



When pipe is stuck . . .

Pipe-Lax gets it free.

IT SOAKS PIPE FREE

Now, from Magcobar research, comes the new way, the economical way of freeing stuck pipe. With new Pipe-Lax, an organic chemical concentrate, most losses of time, money, and patience because of stuck pipe and collars can be eliminated. In extensive field applications, Pipe-Lax has been used to free stuck pipe with better than 85 percent effectiveness! It is so inexpensive, it can be used whenever you have sticking problems.

For the best insurance available against the high cost of fishing for stuck pipe, keep a drum on your well. The sooner you use Pipe-Lax for freeing stuck pipe, the better your chances are of saving an expensive fishing job. Contact Magcobar today for complete details.

Magnet Cove Barium Corporation, Houston, Texas.

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"We need valves for our severe high temperature-pressure applications."

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Key men . . . responsible for maintaining continuous production with minimum downtime . . . know the importance of valve performance!

That's why OIC, with years of experience in the chemical and petroleum industries, developed a complete line of forged steel valves for rugged service in high temperature-pressure applications.

Available for operation on all lines up to 2-inches, OIC forged steel valves are designed to meet your control requirements with minimum replacement and maintenance cost. Consult your local OIC distributor today. He can help you select the exact valve you need.

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"Our men like to use Edward Mudwonder Valves...

...what more could you ask for?"

Ray Bounds, Tool Pusher for the Bay Drilling Corp., Thibodeaux, La., has an excellent reason for using Edward Mudwonder valves on the Drilling Barge Rome. Here's what Ray says:

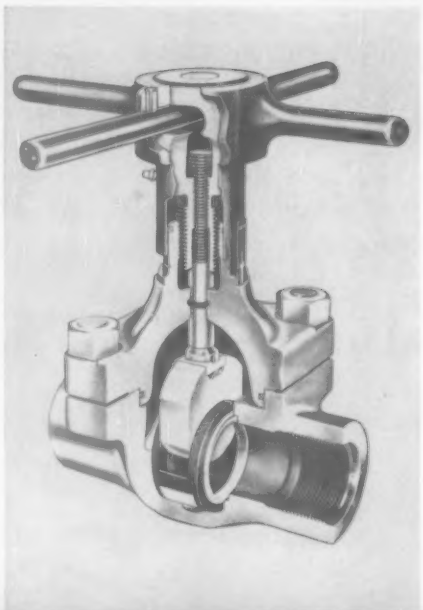
"We've just drilled seven holes in ten months. And we're ready to start on number eight as soon as we get on location. If you know Southeast Louisiana, you know that these are deep wells—13,000 footers—and working pressures sometimes hit 2800 pounds. To keep up a schedule like this means we have to have high-class equipment and good crew morale. *Having good equipment is the biggest morale booster we have.*

"Our Mudwonder mud valves are the kind of equipment the men like to use. Mudwonders are easy to open and close even at high pressure with heavy mud and seventy pounds per barrel of lost circulation material. If our Mudwonders need to be inspected or serviced, the men can tend to it quickly without removing the valves from the line. What more could you ask for?"

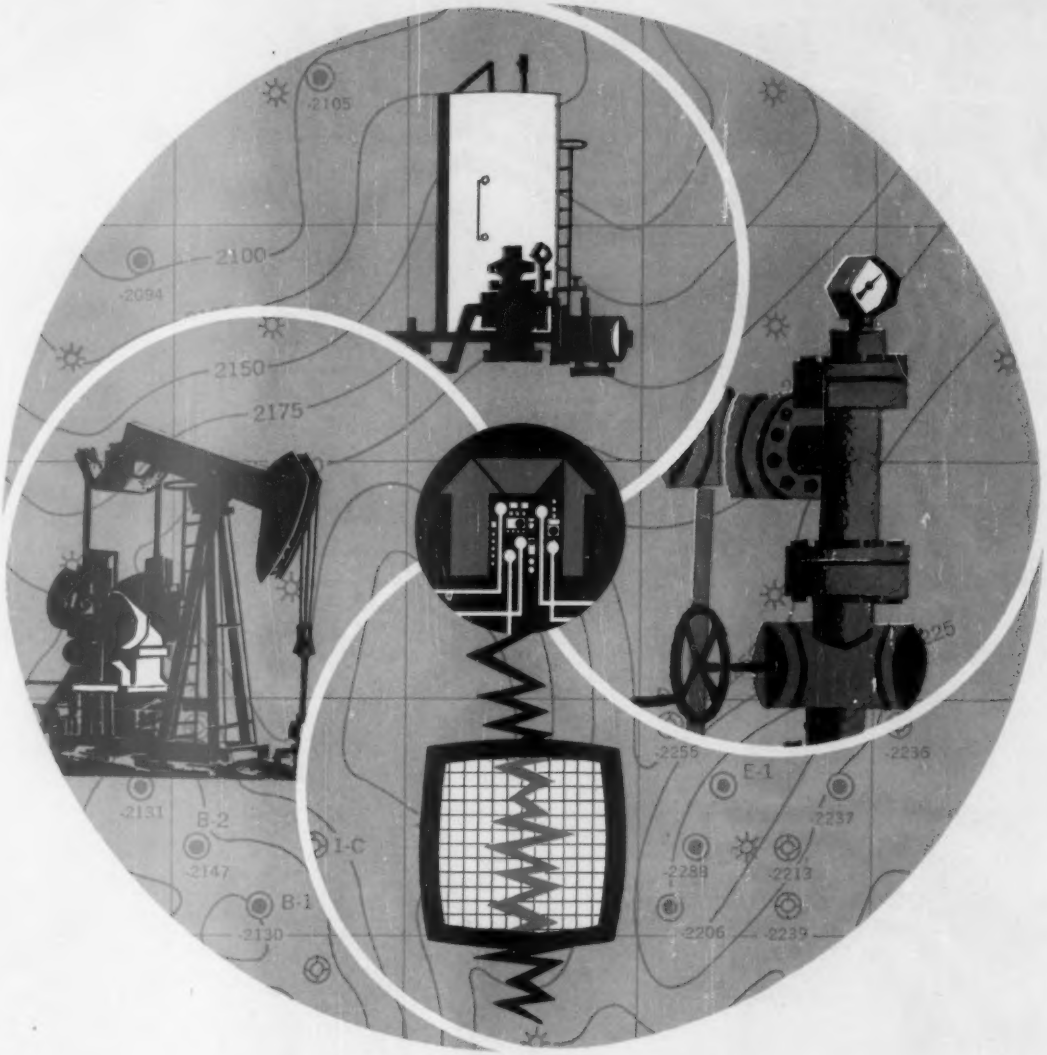
The confidence Ray Bounds has in Edward Mudwonder valves is found wherever you go in the drilling fields. Mudwonder valves are built in 2", 3" and 4" sizes, with screwed or flanged ends, for 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test) service and in 2" size for 5000 psi WP (10,000 psi test) service. See your favorite oil field supply store, or write Edward Valves, Inc., 1212 W. 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company.

EDWARD STEEL VALVES
another fine product by
ROCKWELL

▲ Ray Bounds, Tool Pusher for the Bay Drilling Corp., finds that his men like Edward Mudwonder valves because they are easy to operate and easy to maintain.



◀ Mudwonder cut-away view shows the one-piece seat insert with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.



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Now, with PARACS* you can cut production costs to the bone... You can take advantage of lease consolidation... You can have a system designed to meet the characteristics of a single lease or multiple leases... You can benefit from the experience background of over 40 automated oil field leases... You can get all the advantages of total capability with single source responsibility. Bulletin 12-31 has the facts about PARACS—send for your copy today.

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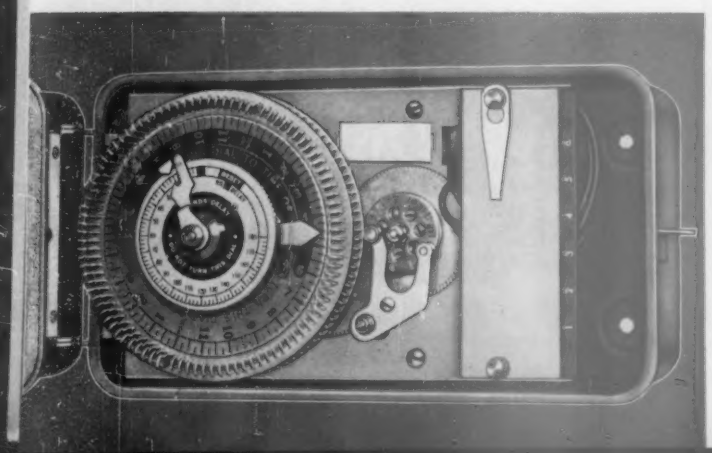
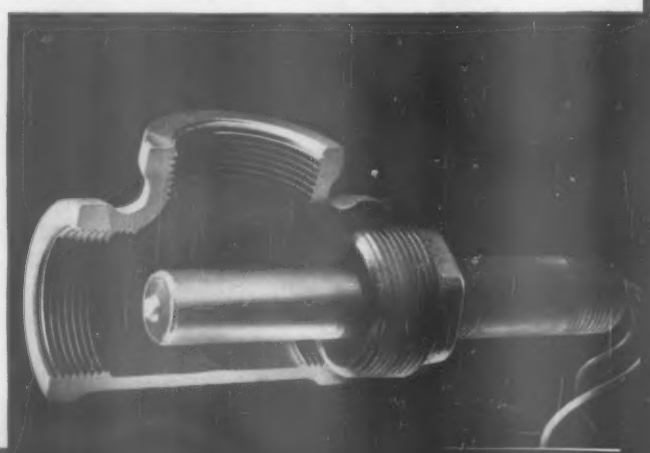
Supertimer performs two major functions in a single unit: 1) programs minutes per hour, hours per day, days per week in pumping schedule. 2) Provides 73 accurately controlled re-starting intervals (zero seconds to 3 minutes). Simultaneous re-starting of any of 73 pumps after power interruption can be prevented by this timer's sequence starting feature.

C-H automatic pump-off control ends dry pumping. An electrically self-heated thermistor measures fluid flow. When well pumps off, thermistor signals transistorized relay that shuts off pump. *Fluid flow* is the sole gauge—no other factors influence pump off. Field tests prove lower oil lifting costs, pumping time savings up to 25%, electricity savings and elimination of severe dry pumping wear.





3-coil protection and day omission features are now standard on Cutler-Hammer controllers

Programmed pumping has made 3-coil overload relay and day omitting features so essential that these "extra options" are the rule in today's pumping operations. Cutler-Hammer has now incorporated both of these design features in the standard line of Three Star oil well pumping control.

3-Coil Overload Relays

These new Cutler-Hammer standard units —size 0 through 4—equipped with 3-coil overload relays provide the ultimate in motor protection—particularly for isolated, inaccessible, or unattended applications. For pump motor protection against overloads, single phasing and unbalanced line voltage conditions, get this additional protection *as part of a standard controller.*

Cutler-Hammer automatically starts, stops and cycles your pumping program to your exact schedule. A simple screw turn permits you to automatically omit any of seven days from your pumping schedule. You get this extra day omitting convenience *as a standard design feature when you specify Cutler-Hammer.*

It is extra features like this—as part of standard controller design—that have made Cutler-Hammer the far-ahead leader in oil well control. For details on twenty-one other C-H design features, write for Pub. LO-16-NL75 . . . better yet, call your local distributor or sales office for details.

WHAT'S NEW? ASK...

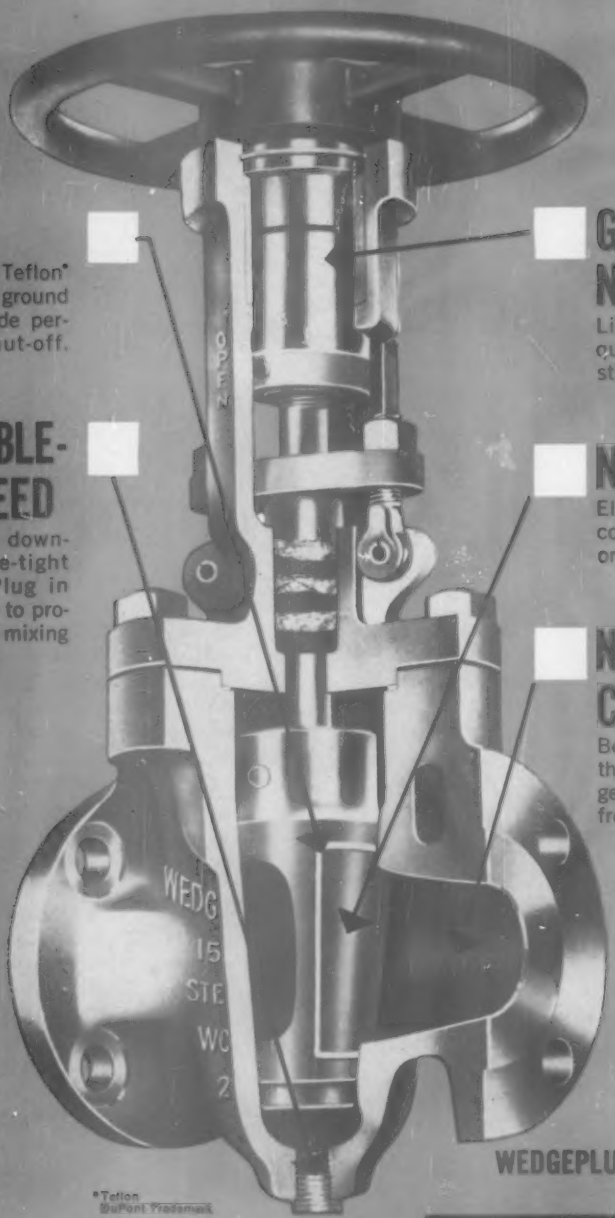
CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer Canada, Ltd.; Cutler-Hammer Mexicana, S. A.

CHECK THE WAYS

YOU'LL SAVE MONEY

WITH STOCKHAM'S WEDGEPLUG O-SEAL VALVE



NO LEAKAGE

Pressure-sealing effect of Teflon* "O" rings in the plug plus ground metal-to-metal seats provide permanent bubble-tight shut-off. Safe in case of fire.

PROVIDES DOUBLE-BLOCK AND BLEED

Both the upstream and downstream seats hold bubble-tight against line pressure. Plug in bottom-boss can be pulled to provide bleed. Absolutely no mixing of products on manifolds.

GUARANTEED NOT TO STICK

Lift-type plug engineered for quick, easy operation. Will not stick.

NO LUBRICATION

Eliminates the high monthly cost of lubricants and labor, or a lubricating service.

NO PRODUCT CONTAMINATION

Because it's non-lubricated, the O-Seal eliminates the danger of product contamination from plug seal lubricants.

*Teflon
DuPont Trademark

WEDGEPLUG VALVE COMPANY
DIVISION OF

STOCKHAM
VALVES *and* **FITTINGS**

AVAILABLE THROUGH YOUR LOCAL STOCKHAM DISTRIBUTOR

Bronze, Cast Iron, Ductile Iron, Cast and Forged Steel Valves
Cast Iron, Ductile and Malleable Pipe Fittings

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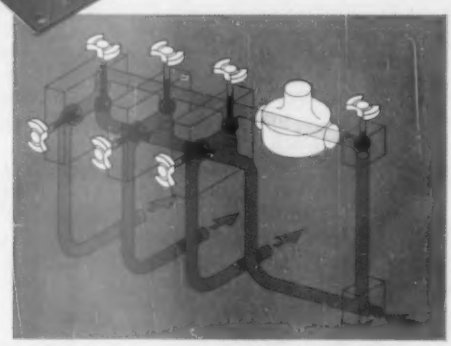
Oilmaster

HYDRAULIC PUMPING CONTROL MANIFOLD

"BUILDING BLOCKS" offer... Simplicity, Flexibility, Economy



Simplicity and Flexibility mean Economy with the new Oilmaster concept for Central Power Control Manifolds. Previously, hydraulic pumping systems required a maze of manifold plumbing to direct and control the rate of power oil flow to individual wells. Oilmaster has refined this plumbing maze to a simplified "building block" control system which is more efficient and easier to operate. This control system is built around well control stations, each having internal valves and ports for power oil distribution and control. One control station is included in the manifold for each well in the system. The manifold also includes the flow meter that allows selective metering of any well in the system. This "building block" design facilitates assembly and installation of Central Power Control Manifolds.

The block construction simplifies the control operation by permitting rapid switching to the meter header without interrupting the controlled flow of power oil to each well. Individual well control blocks are joined by flanged connecting spools which form continuous power oil passages to each block. Additional wells can be added to the manifold with minimum effort and cost... and the manifold or any component is salvable for moving to other installations.

For extra economy and flexibility the stainless steel valve seats are replaceable, and all valve parts are interchangeable with other elements of Oilmaster surface equipment. All valve stems have pressure actuated teflon packing to assure free turning. Large flow passages are provided for minimum pressure loss, and all connections are flanged with face type O-ring seals.

See your Oilmaster or distributor representative for further information or write Fluid Packed Pump, Armco Steel Corporation, 9100 S. Norwalk Blvd., Los Nietos, California for Bulletin 6103.

DISTRIBUTED BY: Beacon Supply Company • Dominion Oilfields Supply Company, Limited • Industrial Supply Company • National Supply Division, Armco Steel Corporation • Union Supply Company

ARMCO Fluid Packed Pump

JEFFERSON GAS TREATING BRIEFS

You Should Have A Planned ETHANOLAMINE ANALYSIS PROGRAM

Any plant using ethanolamines for absorption of either hydrogen sulfide and/or carbon dioxide should periodically review their program of analysis. Each plant will vary in its ability to perform tests depending on the availability of laboratory equipment and experience of laboratory personnel. Large plants are usually able to handle a more comprehensive range of analyses on amine solutions than the smaller plants.

Analysis of plant amine solutions normally falls into three main categories: (1) routine, (2) periodic, or (3) special tests.

ROUTINE TESTS

There are several informative tests on amine solutions which can be performed with a minimum of laboratory equipment and experience by plant personnel. A visual examination of the solution for appearance, color, and insolubie matter can give important clues as to the operation of the solution filters, hydrocarbon contamination and metal salts which affect the color. Determination of free amine content by simple titration with hydrochloric acid is normally used on a routine basis to check the amine strength. Many plants process several different gas streams of varying acid gas content. These variations can produce significant changes in the acid gas loading of the amine solution. It is particularly helpful in such situations to routinely check the total acid gas loading of the rich amine solution. When acid gas loading of the amine solution exceeds recommended levels, it indicates the need of either increasing the amine strength or increasing the amine circulation rate. This prevents accelerated corrosion of heat exchangers and reboilers.

PERIODIC TESTS

The periodic analysis of amine solutions on some regular schedule is an excellent form of preventive maintenance. Trends of the physical condition of the solution indicate remedial action to be taken before serious operating problems are encountered.

Most of the troublesome compounds found during extensive examination of amine solutions are relatively non-volatile, for example, the various heat stable amine salts and degradation products. The cumulative effect of these compounds over extended periods of time can reach serious proportions. The advance knowledge that an undesirable component is accumulating in the solution allows time to take steps to reduce the contamination.

Tests for the amount of combined amine, nitrogenous degradation products, and acid gas contents of both the lean and rich amine solutions (as well as other contaminants known to be a problem) should be run on a schedule to suit the specific needs of each plant. The frequency of these analyses might be anywhere from weekly to semi-annually.

SPECIAL TESTS

The contamination of amine solutions by compounds carried in with the gas stream is not unusual. Typical of such sources of contamination are the introduction of excessive amounts of valve lubricants and compressor lubricating oils, organic acids, carbonyl sulfide and air leaks in gas gathering lines or process streams operating under reduced pressure.

When the source of contamination is not known, it is advisable to use some scheme of qualitative analysis to determine the nature of the compounds. Typical qualitative tests which might be run on a solution where an unusual problem exists are: thiosulfate, thiocyanate, sulfate, chloride, and sodium. Once this is done then quantitative analyses for the specific contaminants may be used to obtain more information regarding the degree of contamination. Tests for iron capacity and foaming tendency are useful tools for indicating the effects of contaminants on the amine solution.

Assistance in establishing a testing program tailored to your needs is available from Jefferson's Technical Service Laboratories in Austin, Texas. Help with problems requiring special analysis can also be supplied. The analytical results will be carefully evaluated and recommendations made for corrective action.

For complete information on Jefferson glycols, ethanolamines, and helpful technical services . . . contact Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.

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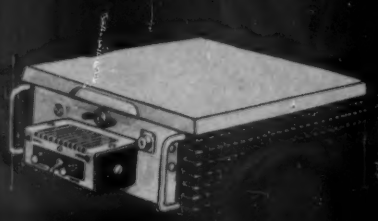
JEFFERSON CHEMICALS

049

VALUE-PACKED



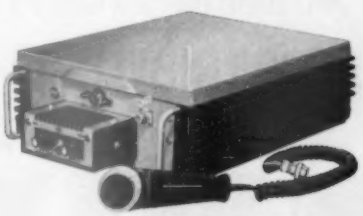
Wisely used transistors enhance the value of RCA "LD" 2-Way Radio and give it built-in dependability

In designing this efficient new "LD" equipment, RCA engineers wisely gave special consideration to the transistor. Only "stock" transistors capable of being serviced with existing test equipment and techniques are used—and only in circuits where they do the best job in cutting battery drain. Tubes are used where they can stand up under high temperatures, heavy voltages—jobs that tubes do best.

As a result the "LD" is not OVERtransistorized, is compact, yet accessible, miserly in power consumption yet value-packed to pack a punch in performance.

Leave the radio on when engine is off—battery drain is negligible. Use it on the roughest roads—transistors and sealed circuits give added assurance it can take it under gruelling conditions.

Specify the RCA "LD" and you can be sure it will stand in back of your endorsement. Lease or purchase plans available. RCA authorized service available. Ask your RCA Representative for complete descriptive literature. Or mail coupon below.



The Most Trusted Name in Radio

RADIO CORPORATION OF AMERICA

RADIO CORPORATION OF AMERICA
Telecommunication Center, Dept. X-89
Meadow Lands, Pa.

Please send me FREE literature on the new RCA Transistorized "LD" Mobile Radio.

☐ Have RCA Communications Specialist contact me and explain why this is today's best value in 2-way radio.

NAME_____ TITLE_____

COMPANY_____

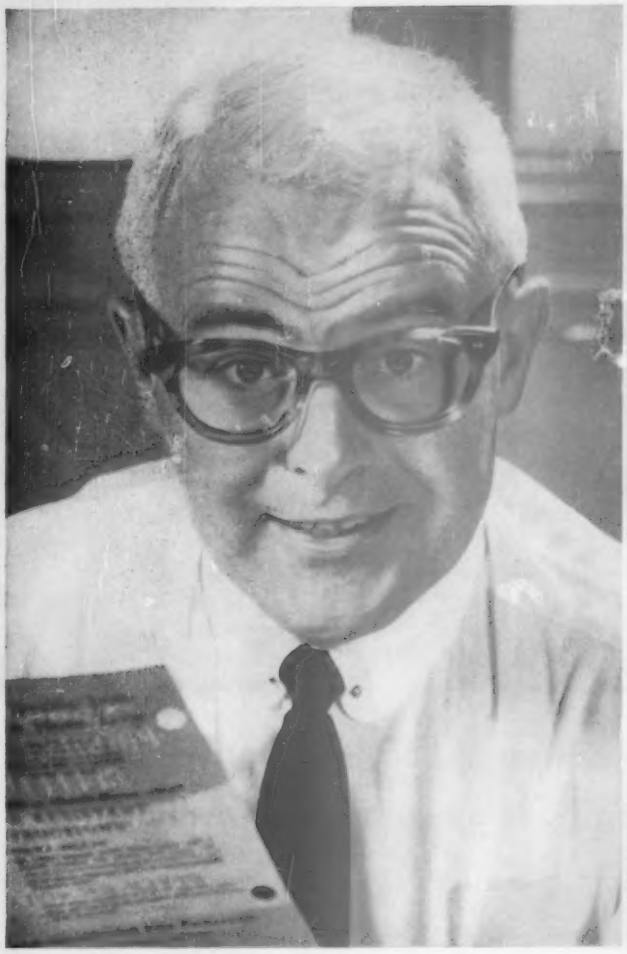
TYPE OF BUSINESS_____

ADDRESS_____ PHONE_____

CITY_____ ZONE_____ STATE_____

GOODYEAR

Hose? Goodyear



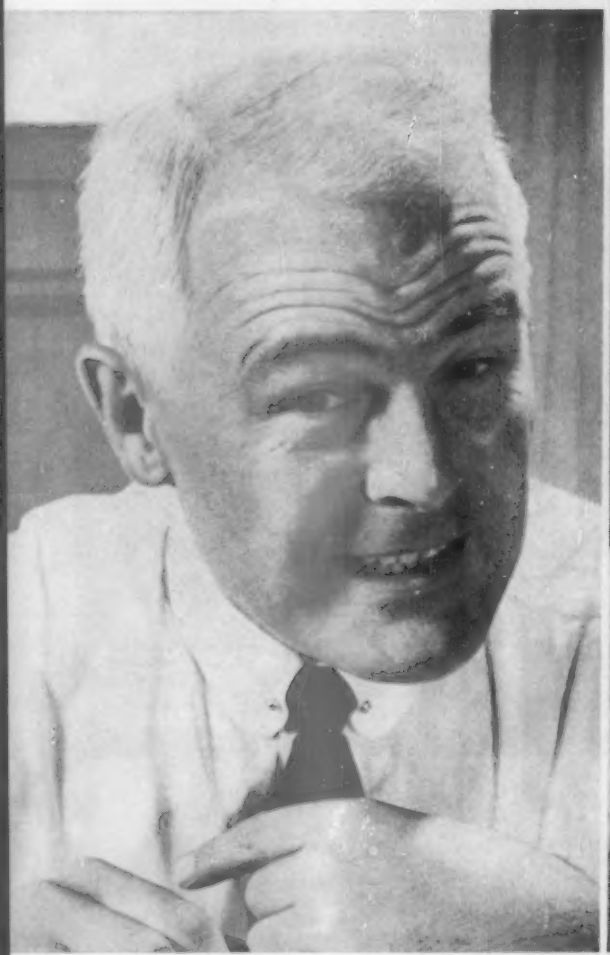
THE KIND I NEED?
(No matter how tough or unusual your application or what type hose it calls for—*Goodyear has the answer!)*

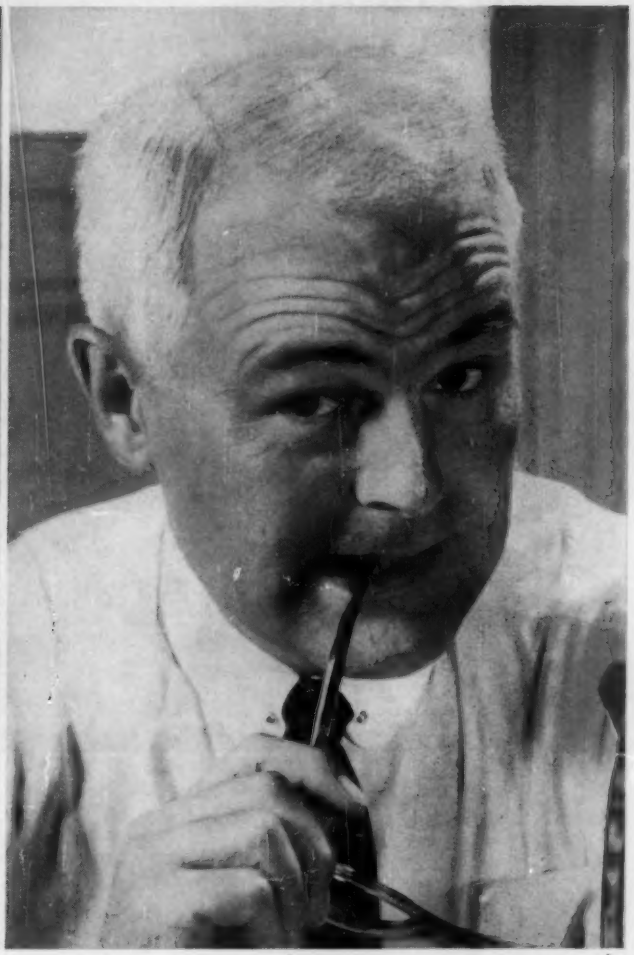
WHEN I NEED IT?
(When you need hose in a hurry—locally available right from distributor stocks—*Goodyear has the answer!)*

FOR THE RIGHT HOSE... AT THE RIGHT PLACE...
CALL YOUR GOODYEAR DISTRIBUTOR... first in

Lots of good things come from GOOD

Has All the Right Answers!





TOUGH AS I NEED IT?
(For the extra ruggedness, extra dependability and extra safety of real quality hose—*Goodyear has the answer!)*

SPECIAL HELP WHEN I NEED IT?
(Call for the advice of an expert like the G.T.M. – Goodyear Technical Man – and *Goodyear has the answer!)*

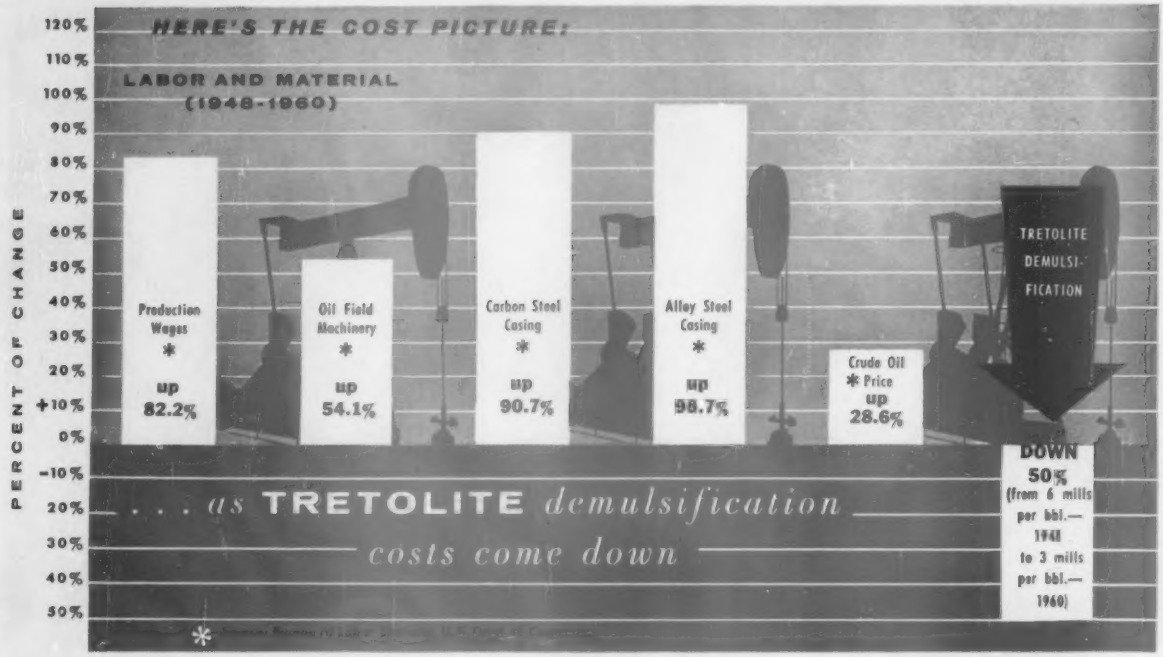
AT THE RIGHT TIME... AT THE RIGHT PRICE...
service with all industrial rubber products

Or write Goodyear, Industrial Products Division, Akron 16, Ohio

GOODYEAR INDUSTRIAL PRODUCTS

OIL PRODUCTION COSTS ARE STILL GOING UP

another
TRETOLITE SERVICE
report



. . . and here's the reason:

It's good news in a period of general spiraling costs—the average cost of Tretolite demulsification treatment has been *cut in half* as other production costs have continued to move stiffly upward!

Why? A major part of the answer lies in Tretolite research . . . a continuing program devoted to the development of newer and better formulations, to constant testing, and to improved methods of manufacture.

If you're caught in the cost squeeze, and would like to produce more salable oil at less cost, we invite you to contact your Tretolite Field Service Engineer (the "Man in the Red Car") for helpful cost-cutting suggestions.

Write now for your copy of the new TRETOLITE DEMULSIFIER BROCHURE

IT'S YOURS ON REQUEST.

PETROLITE CORPORATION

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T-61-1

Stuck pipe? use BOWEN CUTTERS

Bowen Internal Cutter — Runs on sucker rods, tubing, drill pipe or "macaroni" tubing. May be redressed to cut alternate sizes of pipe. Extremely compact.

Bowen External Cutter — Cuts and removes long sections of pipe. Has interchangeable accessories for use on pipe with either coupled, upset or external flush connections.

If you need to cut tubing, casing or drill pipe, Bowen has the right cutter for any job.

Backed by over a quarter of a century of engineering and manufacturing know-how, Bowen cutters are rugged and dependable, yet extremely economical.

Both internal and external cutters are available in a complete range of sizes for all cutting jobs. All Bowen cutters use especially hardened and ground knives for a quick, smooth cut in any grade of pipe.

Bowen Internal Cutters utilize the "Automatic Bottom," which allows the operator to set the cutter easily at any depth, make the cut and release, then re-set and cut again at another depth — all without coming out of the hole.

Bowen External Cutters provide fast and efficient cutting and recovery, with an automatic spring-fed cutter which eliminates broken and burned knives.

Be ready. Write today for your copy of Bowen's technical manuals on Internal and External Cutters.

Available from your service company domestically;
Sold through supply stores for export.

BOWEN ITCO, INC.
P. O. Box 4587
Houston 13, Texas, U.S.A.
Cable Address: ITCO

BOWEN

These seven rock bits were used to drill below 25,000 feet in the world's deepest well. The Hughes Tool Company has specified AISI 4815 since 1934 for the cones of its rock bits.

World's deepest well drilled with nickel steel rock bits

AISI 4815 nickel steel keeps drilling costs down—even at 25,340 feet.

Almost 5 miles straight down. That's where you'll find the bottom of Phillips Oil Company's Pecos County University EE-1.

AISI 4815 nickel steel, carburized and heat treated to produce a hard case and tough core, was used to withstand the punishing abrasion, high stress, and heavy impact encountered in drilling the world's first well below 25,000 feet.

Lower Drilling Costs. However deep you drill, remember that AISI 4815 steel (3½% nickel) provides the strength and toughness for long bit life in the most severe applications. AISI 4815 nickel steel rock bit drill cones deliver more hole per bit—and lower drilling costs.

Less replacement, Less downtime, More savings. That's what you get when you depend on nickel steel for demanding oilfield-product performance.

THE INTERNATIONAL NICKEL COMPANY, INC.

67 Wall Street INCO TRADE MARK New York 5, N. Y.

Phillips Petroleum Company's University EE-1, Pecos County, Texas. Hughes Tool Company's AISI 4815 nickel steel rock bits were used on this job. Hughes' nickel steel rock bits have drilled the equivalent of over 50 times through the earth.

INCO NICKEL

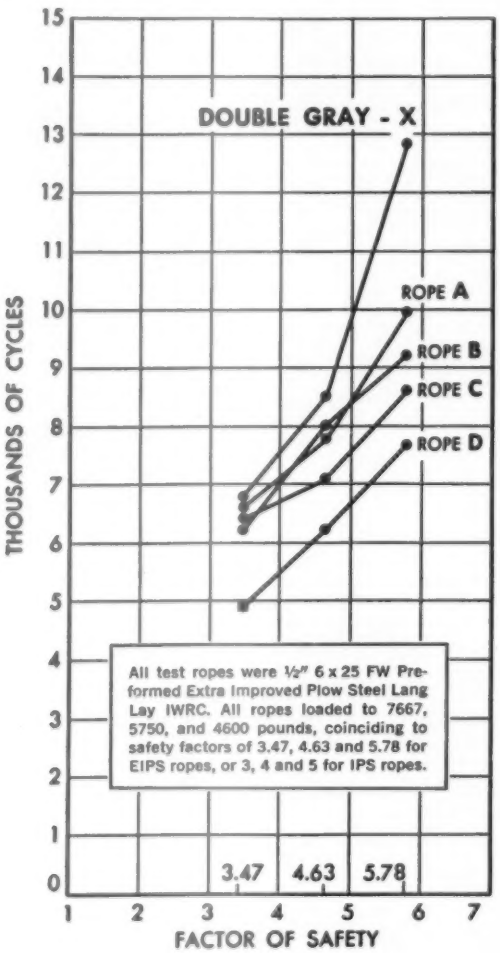
NICKEL MAKES STEEL PERFORM BETTER LONGER

DOUBLE GRAY-X® lasts longer

Tests prove CF&I-Wickwire's premium wire rope has 45%* more bending life than average of other ropes tested

In an extended series of tests conducted at CF&I's Palmer Plant, five brands of wire rope were tested to destruction on a 25,000-pound fatigue machine that bends wire rope back and forth over sheaves until it breaks.

All the ropes tested were made by major manufacturers, and were identical in size and specification. And all exceeded the catalog-breaking strength of extra-improved plow steel rope. But, as the chart indicates, one rope outlasted all the others at every safety factor used in the test. That rope was Double Gray-X!


THOUSANDS OF CYCLES
FACTOR OF SAFETY
DOUBLE GRAY - X
ROPE A
ROPE B
ROPE C
ROPE D
All test ropes were ½" 6 x 25 FW Preformed Extra Improved Plow Steel Lang Lay IWRC. All ropes loaded to 7667, 5750, and 4600 pounds, coinciding to safety factors of 3.47, 4.63 and 5.78 for EIPS ropes, or 3, 4 and 5 for IPS ropes.
3.47
4.63
5.78

At the highest and most commonly-used safety factor, CF&I-Wickwire's premium wire rope lasted 30% longer than the rope that survived next longest, and 68% longer than the rope that lasted the shortest length of time. Double Gray-X lasted 45% longer than the average of all other ropes tested at this safety factor.

Double Gray-X has greater resistance to bending fatigue, the chief enemy of wire rope life, because it is the result of a breakthrough in wire-drawing technology. The use of molybdenum disulphide in the drawing process produces these outstanding fatigue-resistance factors:

- A Molecular Shield . . . which prevents the wires from grinding together as the rope operates.
- Smoother Wire Surfaces . . . providing better resistance to fatigue.
- Extra Toughness . . . because molybdenum disulphide helps preserve the inherent toughness of the wire during drawing.

Double Gray-X can save you money because it lasts longer on even the most punishing jobs, as proved by these tests and by field reports from satisfied users. This longer-lasting wire rope cuts repair and replacement costs, lowers your total wire rope investment and reduces machine downtime. Use the wire rope of *tomorrow* today! Ask your CF&I salesman for complete details.

*Percentage above average of all other wire ropes tested at safety factor of 5.78.

The Colorado Fuel and Iron Corporation
Denver • Oakland • New York
Sales Offices in All Key Cities

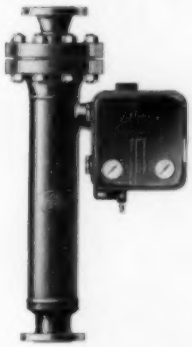
*

Little more than a speck in the Gulf of Mexico, a separator platform must hold all the equipment necessary to serve a number of producing wells. There just isn't room for extensive stock of replacements. It takes a launch at least 5½ hours to make a 60-mile trip; a helicopter at least 45 minutes. Under these conditions controls have to stand up day after day and week after week. That's why Fisher Level-Trols are chosen for offshore operations as well as for liquid level control applications throughout the world.

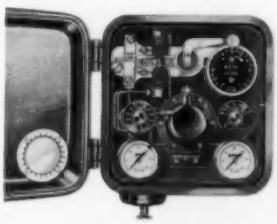
FISHER LEVEL-TROLS®

for accurate, trouble-free liquid level control on a wide range of applications....

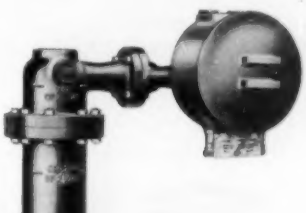
THREE BASIC CONTROLLERS



THE POPULAR TYPE 2500 PROPORTIONAL CONTROLLER—This compact and economical liquid level controller provides a proportional band adjustment up to 100%. It is pneumatically operated and level position is manually adjustable for quick, simple selection of set point. The 2500 is suitable for 3 to 15 psi or 6 to 30 psi output ranges. Controller action easily reversed in the field. Available in all styles of mountings and housings and in displacer lengths 14″ through 120″.



TYPE 2502 PROPORTIONAL RESET CONTROLLER—This Level-Trol includes, in the same size case, all the features of the Type 2500, plus reset action. It, therefore, brings the set point back, automatically to its original position and assures absolutely stable control. Proportional band adjustable to 200% and reset rate is adjustable from .005 to 1 minute per repeat.



TYPE 2300 ELECTRONIC CONTROLLER—Explosion-proof design for hazardous locations. External adjustments for proportional band (10 to 100%) and liquid level set point. Mounts on standard Level-Trol housings. Available for output DC signals 1 to 5 ma, 4 to 20 ma or 10 to 50 ma. Has plug-in converter with printed circuit. For more information on Fisher Level-Trols write to:

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / Rochester, England

BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIP. CO., CORAOPOLIS, PA.

If it flows through pipe anywhere in the world ...chances are it's controlled by.....

FISHER® Controls SINCE 1880

the case for using a SWACO D-GASSER on most of the wells you drill

Many operators and drilling contractors don't realize how D-Gassers can help them reduce the over-all cost of wells. By removing entrained gas and air from drilling mud after each circulation, the D-Gasser permits improved control of mud characteristics. As a result, many operators can profit from some of the following savings:

SAVES MUD AND CHEMICALS. If gas-cutting is encountered, the chances are good you can save on mud bills. The D-Gasser usually permits drilling without adding weighting material even though the well is "kicking" from drilled gas. It has been possible to keep mud weights more than a pound lighter than would have been possible without the D-Gasser. Over-treatment of mud (and the resulting stuck pipe and formation trouble) can be avoided when the D-Gasser is used. Trip gas and viscosity increases due to dissolved and entrained gas may be controlled without costly and time-consuming mud treatment.

SAVES LOST CIRCULATION MATERIALS. Since the D-Gasser often makes it possible to continue drilling while the well is "kicking", lighter mud can be used and lost circulation problems may be held to a minimum.

PERMITS FASTER, LOWER COST DRILLING. Drilling rates and/or footage per bit may be increased since light, low-solid muds may be used. Total drilling time may be reduced and fewer round trips may be required.

SAVES CASING. Frequently, operators avoid the expense of setting a long string just to evaluate a minor gas show. By eliminating the recirculation of gas, the D-Gasser prevents exaggerated impressions from minor shows. Occasionally, it has been possible to save an intermediate string when a D-Gasser is used.

SAVES WELLS. Many high pressure exploratory wells have actually been saved by the D-Gasser. Costly blowouts, fires and lost holes have been avoided. For full information on how the D-Gasser can help you, contact your nearest SWACO representative or write us direct.

SWACO

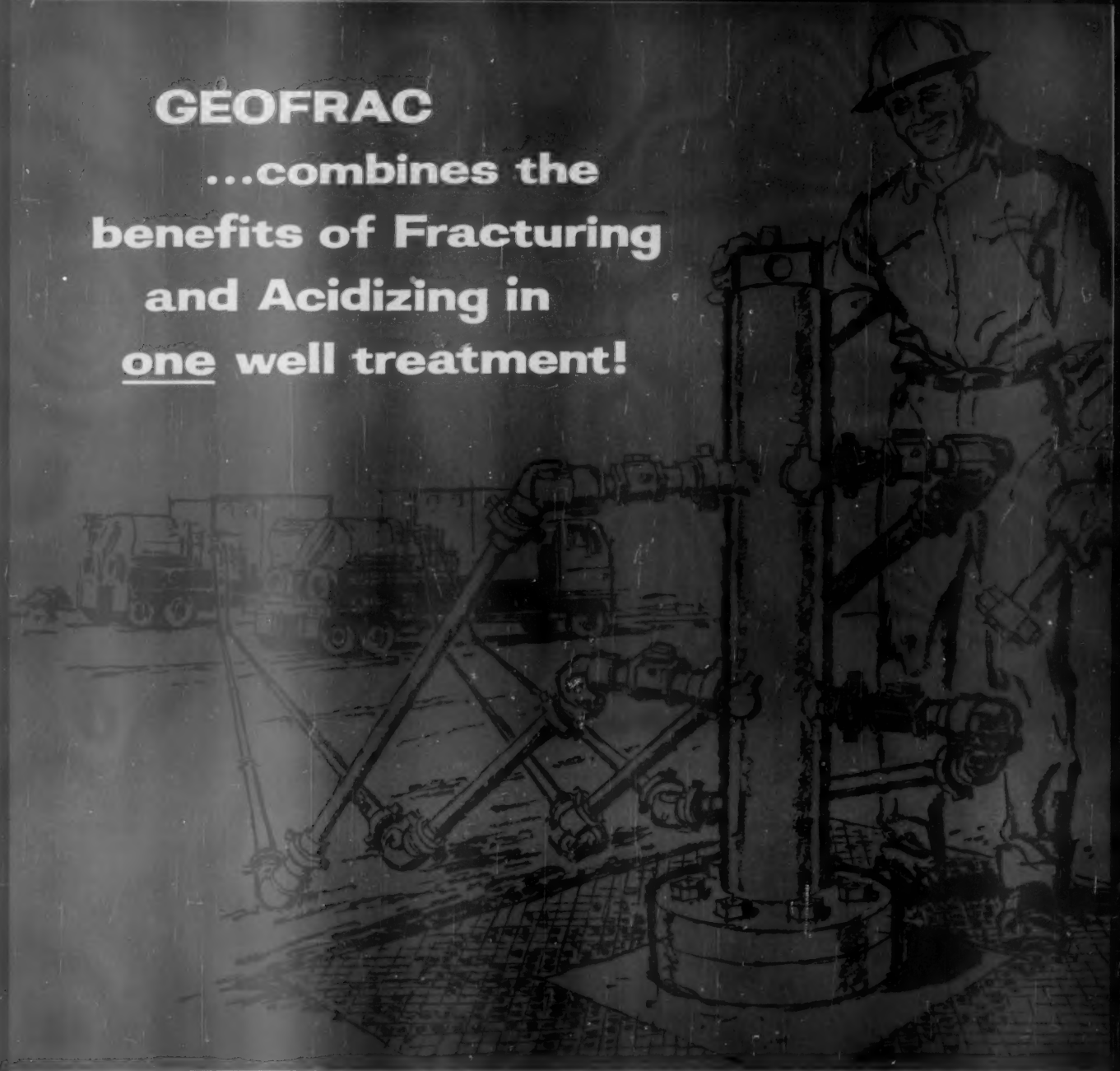
SALT WATER CONTROL, INC.
717 FT. WORTH NATIONAL BANK BLDG., FORT WORTH 2, TEXAS
Telephone: EDison 2-4433 Cable Address: "SWACO" Fort Worth

LOUISIANA: New Orleans, Lafayette
OKLAHOMA: Oklahoma City
•
TEXAS: Houston, Corpus Christi, Fort Worth, Kermit
NEW MEXICO: Farmington

SWACO

GEOFRAC

...combines the benefits of Fracturing and Acidizing in one well treatment!



Fracture and acidize in *one* operation with this superior BJ Service treating fluid. An acid in oil emulsion, Geofrac is a dual-purpose, sand-carrying fluid that has proven especially effective in limestones, dolomites and conglomerates, or other formations where carbonate dissolving action is desired. After the fracturing phase, with pumps shut down, Geofrac *continues* to work chemically within the pay. Its low fluid loss, high viscosity and temperature stability provide deep formation penetration—with no external gel breakers required. Selective, too. Since oil is the external phase, Geofrac penetrates oil-bearing formations more readily than water-bearing ones. Geofrac is available in both 5% and 15% inhibited acid strengths—and *only* from BJ Service.

For complete details, call your local BJ Service field station today.

Commander Pumping Unit

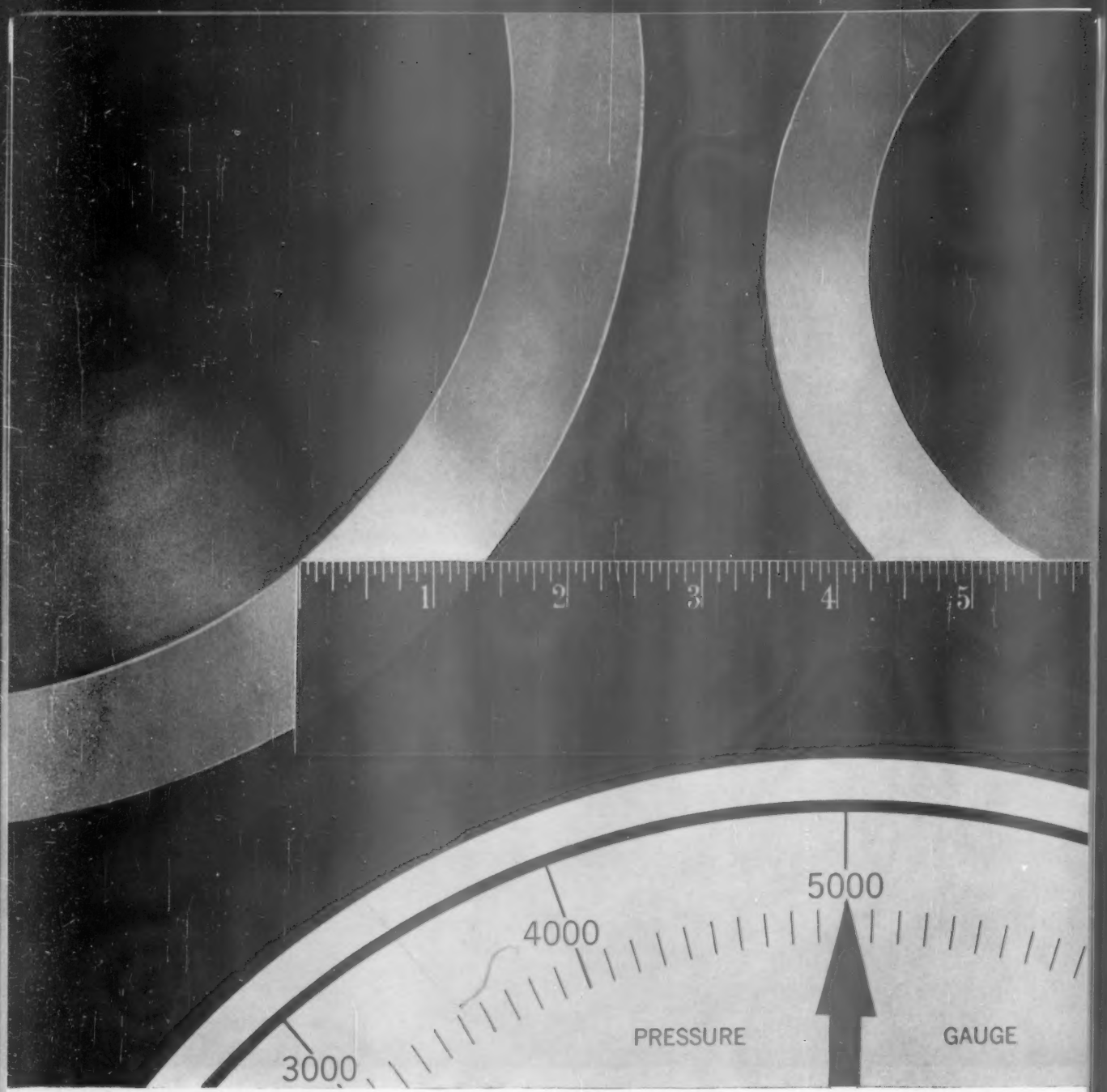
Designed and built by BJ Service, this superior all-purpose unit pumps the highest fluid rates in the field (up to 45 BPM)...also handles high-pressure jobs with ease. Commander features include two triplex ram pumps...engines with a high horsepower/weight ratio...automatic exhaust cooling...smooth performance at all speeds and pressures.

BJ SERVICE, INC.

A BORG-WARNER SUBSIDIARY

Long Beach, California • Arlington, Texas • Stations in all major oil fields

BJ B-W SERVICE



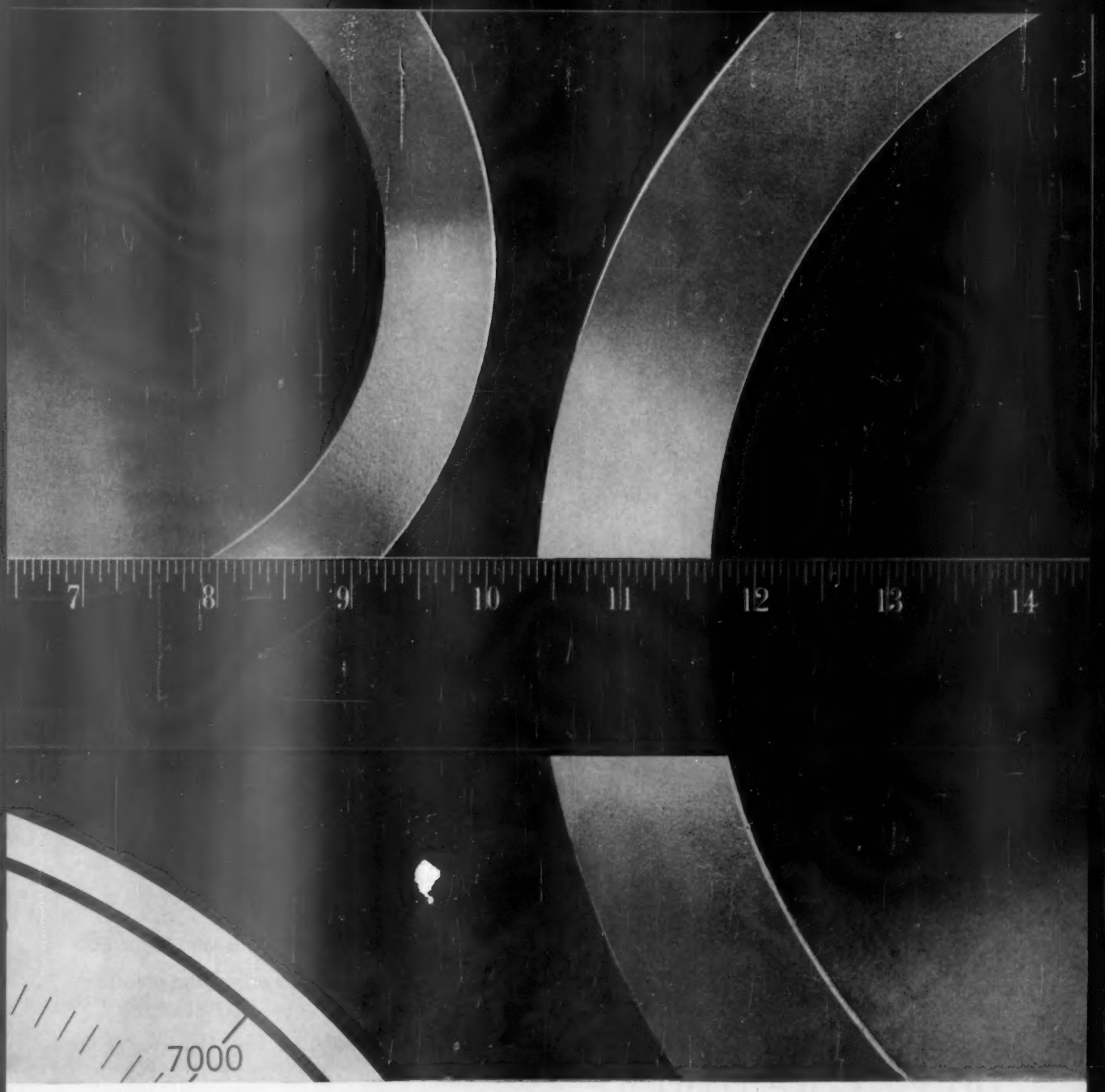
It takes cannon-barrel pipe to store gas at 5,000 psi

North of the Susquehanna River near Renovo, Pennsylvania, is a depleted gas reservoir known as Leidy Field. It has just been converted into an underground gas storage field. The field has a total of 85 wells and is roughly 13 miles long and 7 miles wide.

To store gas in this natural reservoir when completed requires an injection pressure of 5,000 psi at the wellhead. This storage field provides for a peak withdrawal of 800 million cubic feet each day and an average withdrawal of 400 million cubic feet per day during the winter season.

Seamless Steel Line Pipe was selected for this

This mark tells you a product is made of modern, dependable Steel.



project, because the high pressures demanded strong, reliable pipe with almost cannon-barrel thickness. Pipe walls ranged up to 1.312" in thickness in pipe size 6⅝-inch to 12¾-inch.

USS National Seamless Steel Line Pipe met these requirements. It is ideal for lines that handle gas, liquids and solids. It's available in a complete range of wall thicknesses, steel analyses, and in diameters up to 26 inches—USS National Electric-Weld Line Pipe up to 36 inches. Write for information on our products, services and facilities. National Tube Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS and National are registered trademarks

National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

THIS GROVE FLEXFLO® REGULATOR IN THE LINE 5 YEARS WITHOUT SERVICE

Handling flow rates from 3 to 5 MMSCF/hr 300 psig to 380 psig inlet, 53 to 55 psig outlet pressures

This 8" model 80-896 Flexflo has been under the above service without maintenance for over 5 years at Pacific Gas and Electric Company's Moss Landing plant. A similar "standby" unit has never been uncrated. There are many case-proven examples of the reliability, dependability and maintenance-free service of Grove Flexflo pressure reducing and relief regulators. Such service, plus the amazing simplicity and versatility of Flexflos, makes them worthy of your consideration. For complete technical presentation, write for Bulletin 800.

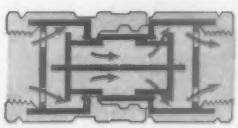
GROVE REGULATORS
GROVE VALVE AND REGULATOR COMPANY
A subsidiary of Walworth
6529 HOLLIS STREET • OAKLAND 8, CALIFORNIA
Offices throughout the U.S. and in Western Canada

7233

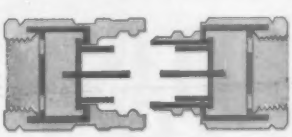
Hey, Herman... Snap-Tite valved couplings come in big sizes too!

There's a size and type to handle almost anything that flows

TO USE SNAP-TITE VALVED COUPLING:



CONNECT—Full flow instantly



DISCONNECT—No flow instantly

Snap-Tite can provide the right size valved coupling for most any use . . . with quick off-on action wherever coupling or shut-off is required.

"H" series valved couplings for high pressure applications. High resistance to heavy line surge. Sizes from 1/8" through 6". Larger sizes on special order.

"IH" series valved couplings for greater impact in air lines. 1/8" through 1/2".

"E" series valved couplings for vacuum and very low pressure. Recommended for gravity flow. Sizes from 1/8" to 6". Larger sizes on special order.

"T" series valved couplings for hard to handle fluids. The only valved quick-disconnect couplings now on the market for fluid temperatures from −40°F to +400°F. Sizes from 1/2" through 3".

Snap-Tite valved couplings are available with two-way or one-way automatic line shut-off. They are normally furnished in alloy steel. Also available in brass, aluminum, or stainless steel with a variety of finishes.

Write for Snap-Tite Catalog No. 58 for more information on Snap-Tite valved couplings.

Snap-tite
UNION CITY, PA.

BT-59-02

SPECIAL REPORT TO MANAGEMENT

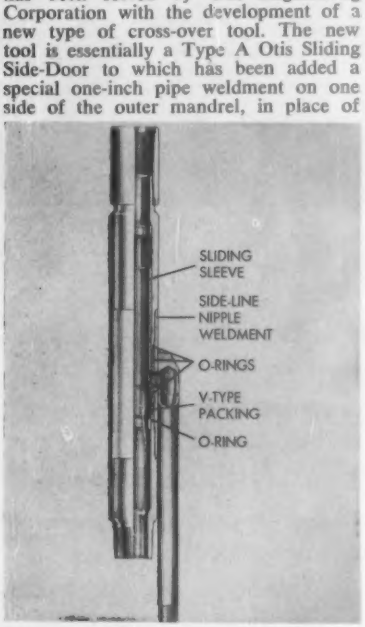
OTIS PRODUCTION NEWS

Volume II, Number 2 | **Otis Engineering Corporation • Dallas** | *Production Equipment and Services*

New Otis Cross-Over Tool Solves Zone Feeding Problem In Single String Dual Completions

Sliding Side-Door® With Special Weldment Provides Complete Zone Isolation With Cross-Over Chokes Out of Well

CORPUS CHRISTI — Another downhole completion and production problem has been solved by Otis Engineering Corporation with the development of a new type of cross-over tool. The new tool is essentially a Type A Otis Sliding Side-Door to which has been added a special one-inch pipe weldment on one side of the outer mandrel, in place of



the usual slotted ports. The tool is designed to be made up in the tubing with a short tubing sub and Type S Otis Landing Nipple above it and a tubing sub and Ported Landing Nipple below it, and then set in a dual or by-pass type packer. When installed with a Type SS Otis Plug Choke set in the ported nipple, the sleeve may be opened to permit production from the upper zone to be brought into the tubing through the one-inch pipe weldment while flow from the lower zone is directed into the annulus.

See schematic well diagram — right

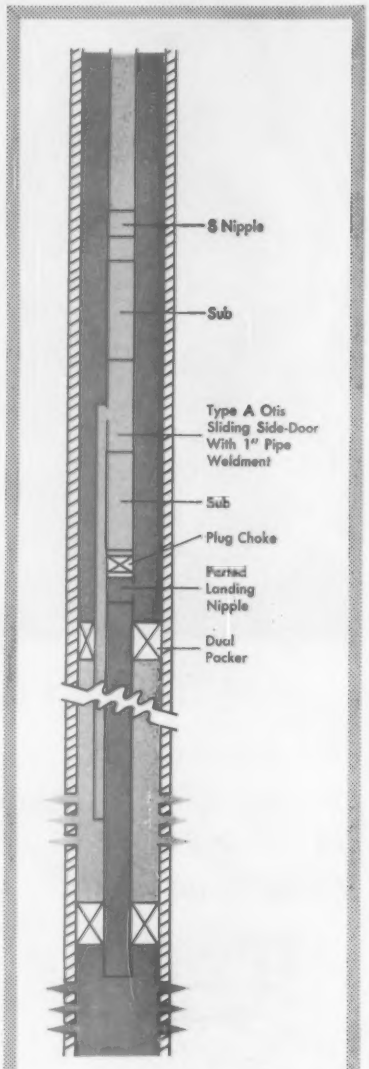
If desired, a straight flow choke may be landed in the assembly to permit production of the lower zone through the tubing while flow from the upper zone is produced through the annulus.

This new Otis Sliding Side-Door Cross-Over was developed at the request of a progressive Texas-based producing company which had experienced extended periods of lost production from the low pressure zones in its single string dual completions after changing a cross-over choke in conventional cross-over equipment, or when a choke had been out of the well for a short period of time for various types of wire line work. This loss of production proved to be the result of the high-pressure zone feeding the low-pressure zone.

According to the company, the new Otis Sliding Side-Door Cross-Over not only proved effective in solving its zone feeding problems, but it has also eliminated the need of having a pump truck on location to equalize pressure across the two zones — as was frequently necessary before the choke could be removed from conventional cross-over equipment. The company also reports it has successfully fractured the upper zone of a number of its wells through the one-inch pipe without damaging the tool.

The Type A Otis Sliding Side-Door, from which this new type of cross-over was derived, is a circulating and production tool which is used downhole to provide selective communication between the tubing and the annulus. The tool has a ported sleeve which is designed to be moved up or down within a ported mandrel. The sleeve may be shifted by one of two ways: 1) by standard wire line methods, or 2) by pumping down an expendable shifting tool. V-type packing and O-rings are used to provide a positive seal between the sleeve and the mandrel when the sleeve is closed.

The new Otis Sliding Side-Door Cross-Over is another example of the ingenuity of Otis' well completion specialists in the field and its engineering department in Dallas. Literally thousands of production problems of this nature have been solved by Otis over the past 32 years. For more information on the new Otis Sliding Side-Door Cross-Over, or for help with any specific production or completion problem, call the Otis office nearest you or write Otis, Dept. 2-W, Box 35206, Dallas 35, Texas. You will find your Otis specialist ready to help you — anxious to serve you.



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OTIS

Engineering Corporation

General Offices:

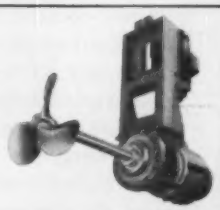
6612 Denton Drive • Dallas, Texas

INSTALL IT–THEN FORGET IT

Here's a big-tank mixer you can count on. Philadelphia's precision-hobbed gear reducer is self-lubricating, perfectly matched; runs for years without maintenance. Tight? You bet. Philadelphia has the surest seal you can find on a side-entering mixer — right up against a supporting bearing, where shaft runout and deflection are at a minimum. And it's a simple job to replace the seal, if necessary—or to repack the optional stuffing box. Lock the positive shut-off collar in place, then make the change without losing a drop of product. Your Philadelphia mixer can be back at work in less than 30 minutes.

For reliable month-after-month, year-after-year operation, specify Philadelphia. Philadelphia Mixers do what they're sold to do. Philadelphia Mixers mix . . . and keep on mixing.

Get Facts on agitator performance, sizing, positioning. *Shaft Seal* section describes replacement of mechanical seal, details stuffing box repacking. Read how Philadelphia Side Entering Mixers deliver twice the power, take up just half the space. Request 12-page Bulletin PSE-60 on your letterhead today.



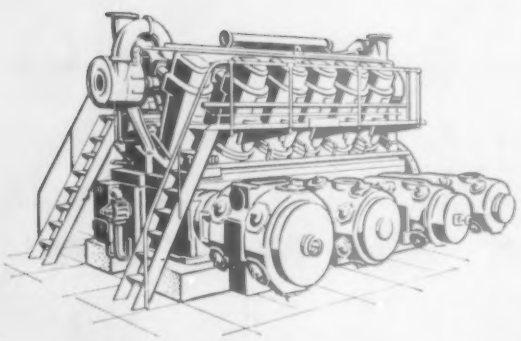
PHILADELPHIA MIXER

DIVISION OF PHILADELPHIA GEAR CORPORATION
King of Prussia (Suburban Philadelphia), Pennsylvania

ASK ANY ENGINEER / GEARS ARE THE HEART OF A MIXER

AGMA MEMBER

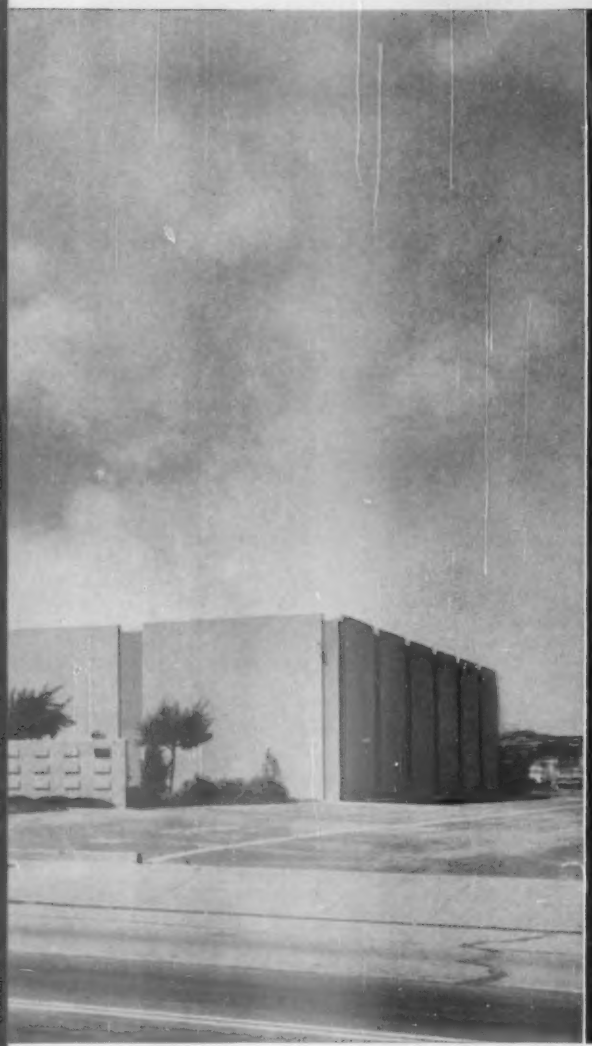
"SHOPPING CENTERS"



Across the United States and Canada, and throughout the world, Ingersoll-Rand's growing network of warehouses and service centers assures maximum availability for your I-R gas-engine compressors.

From these modern, well-equipped facilities you get prompt shipment of replacement parts and fast engineering service whenever they're needed, to keep your machines on the line year after year.

The result is double-protection for your oper-



Branch offices and warehouses are located for quick response to every need, from application engineering to installation and maintenance. Large stocks of factory-made parts are kept ready for immediate supply.

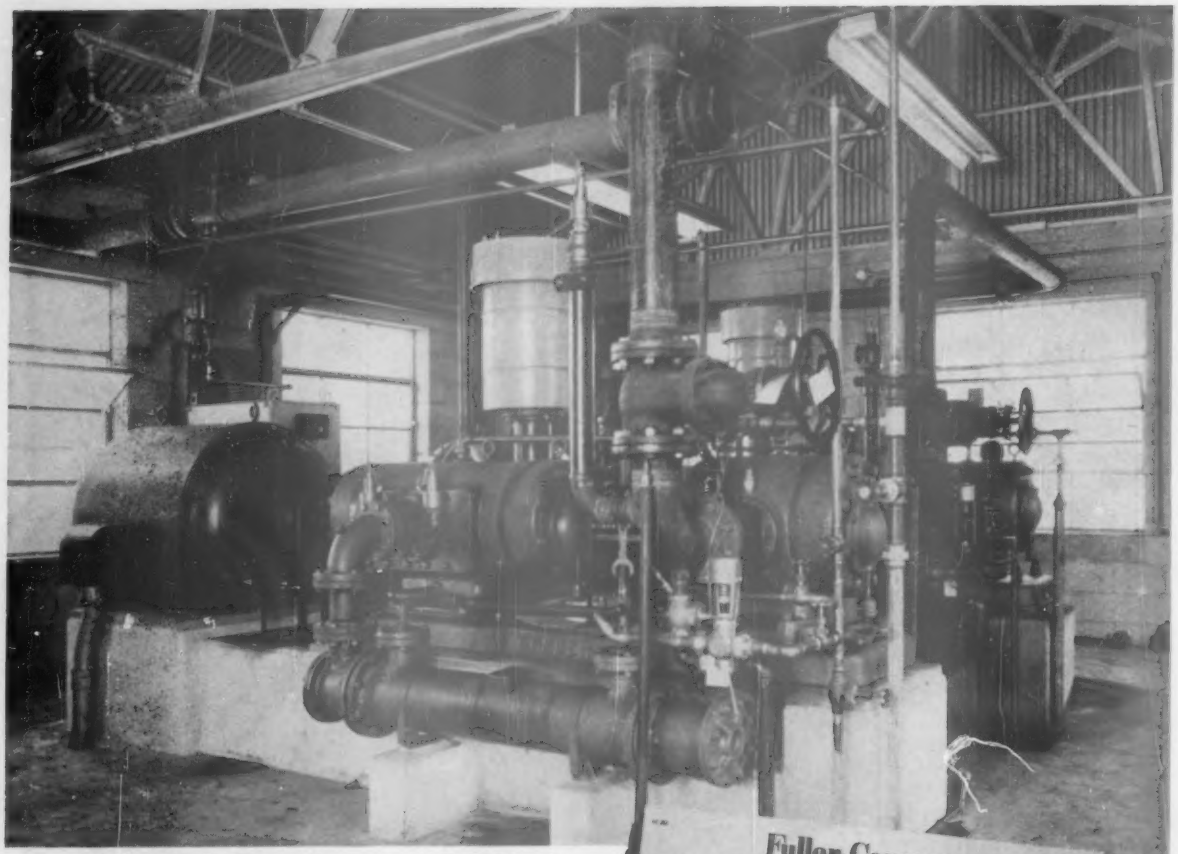
that keep your engine-compressors on-line!

ation — the inherent reliability of I-R 4-cycle V-angle engine-compressors, backed up by Ingersoll-Rand's newly-expanded and still-growing service organization. I-R builds engine-compressors from 120 to 4500 hp, and also offers the *most complete* line of other compressors, in reciprocating, centrifugal, axial-flow, rotary and thermal types; there are units from ½ to 25,000 hp, for pressures from one micron to 125,000 psi. Call your I-R man today for help with your compression problems.

Ingersoll-Rand

239A6 11 Broadway, New York 4, N.Y.

The World's Most Comprehensive Compressor Experience



Two C135/135H Fuller Rotary Compressors at the Herbrand Division of the Bingham-Herbrand Corp., Fremont, Ohio, leading manufacturer of forged mechanics' hand tools and steel forgings for the automotive industry. Each compressor is rated 680 cfm, atmosphere to 100/110 psig., at 690 RPM.

Here's the 4-Year Maintenance Bill on Fuller Rotary Compressor at Herbrand Division of Bingham-Herbrand Corp.

So satisfactory was the performance of its first Fuller Rotary Compressor, installed in 1956, that Herbrand Division installed another like it 3½ years later.

When the older unit was inspected after four years operation, no replacement of parts was necessary. After installation of a new gasket (cost $9.35)—to replace the one that had to be removed to make inspection—the compressor continues to add to its service record.

The newer compressor has also been entirely trouble-free, and Herbrand plans a third, when increased air capacity is required. It, too, will be a Fuller—for, as Herbrand says, "These compressors can be classified as maintenance-free."

Because Fuller Rotary Compressors are practically vibration-free, they can be installed without complicated or expensive foundations or structural modifications. They are simple and efficient, with no valves to leak, no seats to grind. Blades automatically compensate for wear. They have forced-feed lubrication to all parts within the cylinder. Rotor, bearings and blades are the only moving parts.

Fuller Compressors range from 30 to 3300 cfm, pressures to 125-lb. gauge.

Write for Bulletin C-5A. It tells the whole story.

See Chemical Engineering Catalog for further details and specifications.

FULLER COMPANY GENERAL AMERICAN TRADE MARK

FULLER COMPANY
132 Bridge St., Catasauqua, Pa.
Subsidiary of General American Transportation Corporation
Offices in Principal Cities Throughout the World

Fuller
...pioneers in harnessing AIR

2852
C-364

Anti-lock prevents relative rotation between anchor cage and tubing while running

Re-latch threads prevent upper slips from setting until ready.

Long, flexible drag springs allow easy recovery in case of washover.

Special seal protects against fouling from sand or scale.

Internal shoulder creates a differential piston inside rubber to cause a tighter seal.

Full setting force is transmitted to packing element through lower head. No scrubbing action between lower slips and casing wall during setting stroke.

Guiberson permanent completion

TYPE A DRILLABLE PACKER

runs and sets easily, quickly

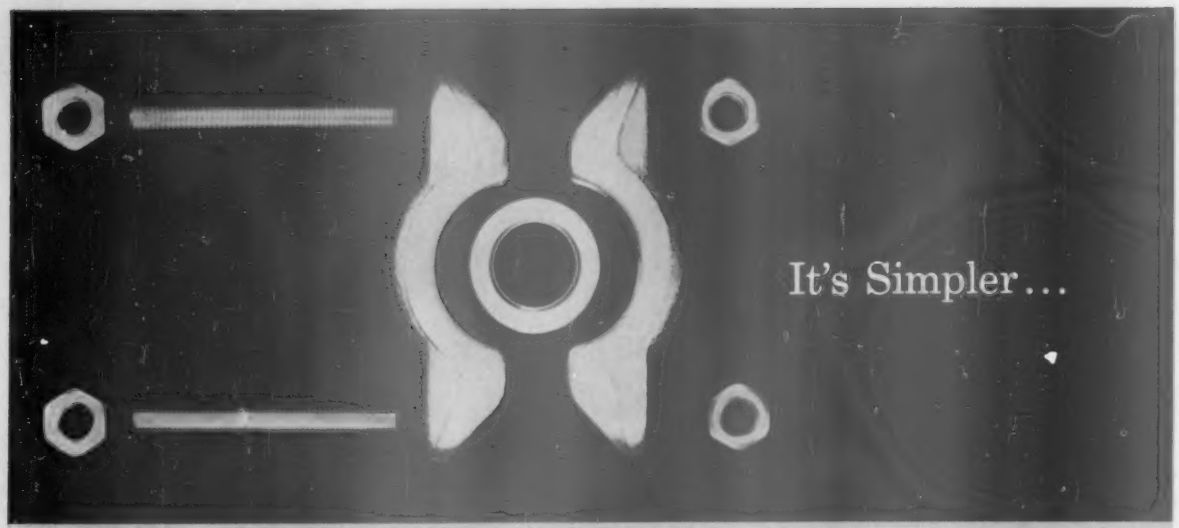
- ***Built-in safety against premature setting***
- ***Set and produce in ½ tubing trip***
- ***Unequalled rubber seal***

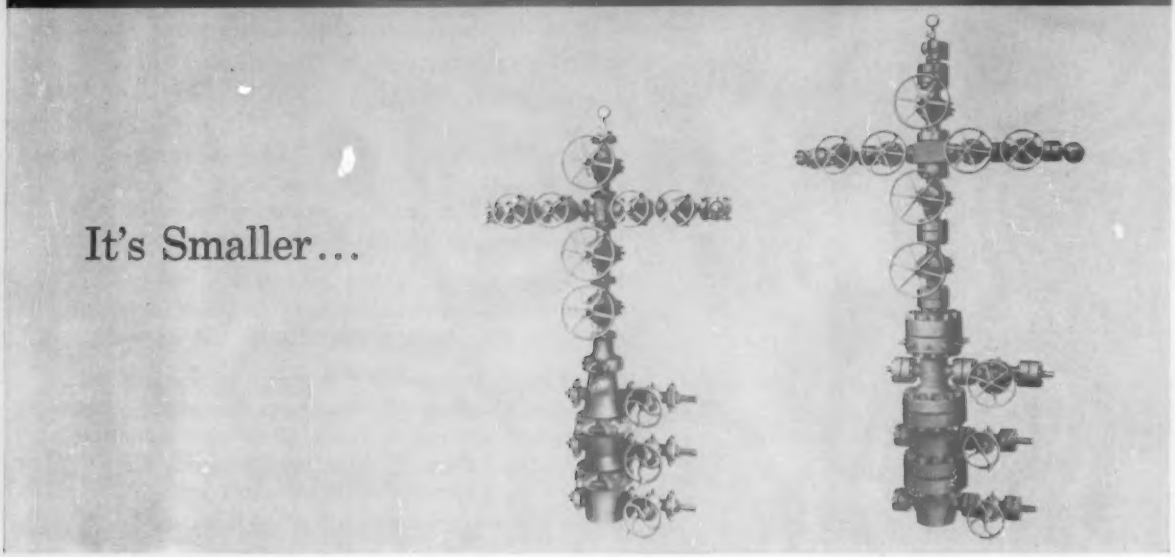
Guiberson Type A Drillable Packer gives you a versatile packer for many uses..single or multiple zone production, acidizing, pressuring operations, water-flooding, testing, corrosion control and many others.

New safety factors against premature setting are provided since the transmitting of drag from tight casing or impact from junk is direct to the tubing string.

The Type A can be set and placed in production with only ½ tubing trip. Spacing problems are easier, especially when run in combination with a multiple zone packer. From rig floor to completion, the Type A runs and sets faster than any other permanent packer.

Guiberson superior quality rubber and special lead-alloy thimbles compress fully for a leak-proof seal. Setting is quick, easy and uncomplicated..may be set by wire line. Available in 5" through 7⅝" sizes for 2" or 2½" tubing with a full line of stingers and accessories. Ask your Guiberson representative for a recommended installation or write for full details.





It's Better BECAUSE OF GRAYLOC

With only two bolts per connection, there's no simpler connection to assemble—and because *Grayloc*® connections require less space, the complete assembly is smaller. Yet for all its simplicity and compactness, *Grayloc* Wellhead Assemblies have been used on the highest pressure wells thus far discovered.

Grayloc connected assemblies are faster and easier to install, weigh less and are less expensive than equally rated flanged assemblies. They resist vibration and retain a tight seal after original assembly without further attention.

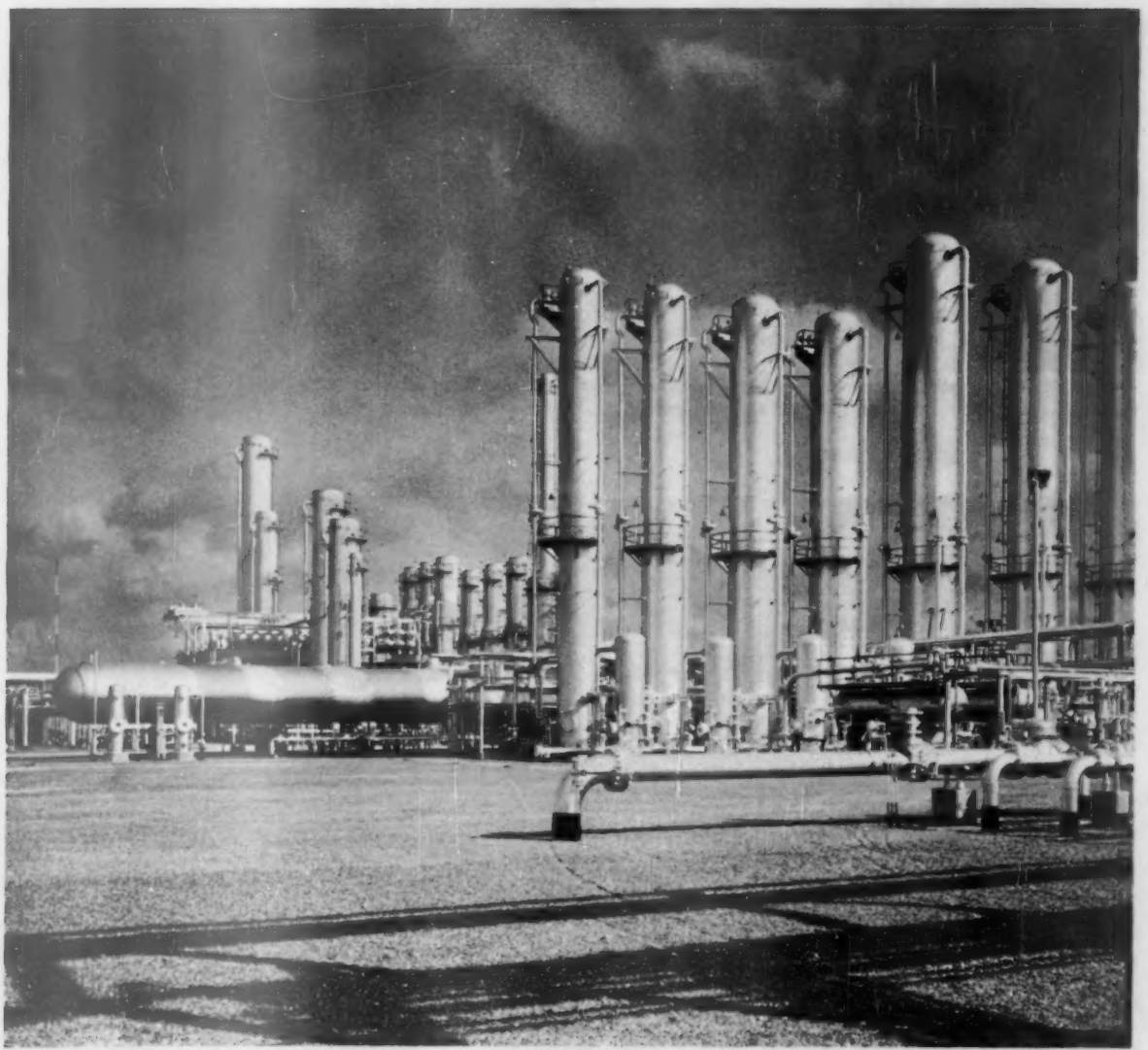
A Gray representative will be glad to show you how much better *Grayloc* connected wellhead assemblies can work for you. Write today for additional information and the Gray catalog.

GRAY *Tool Company*

6103 P. O. BOX 2291 HOUSTON 1, TEXAS RIVERSIDE 7-1240

Westinghouse reports on:

Nation's newest and largest Gas Cycling Plant



This new giant plant in the southwest which gathers, processes and distributes natural gas and its by-products, has a maximum rated capacity of 950 million cubic feet per day. All electric drives and distribution equipment at the 151 acre plant site were provided by Westinghouse.

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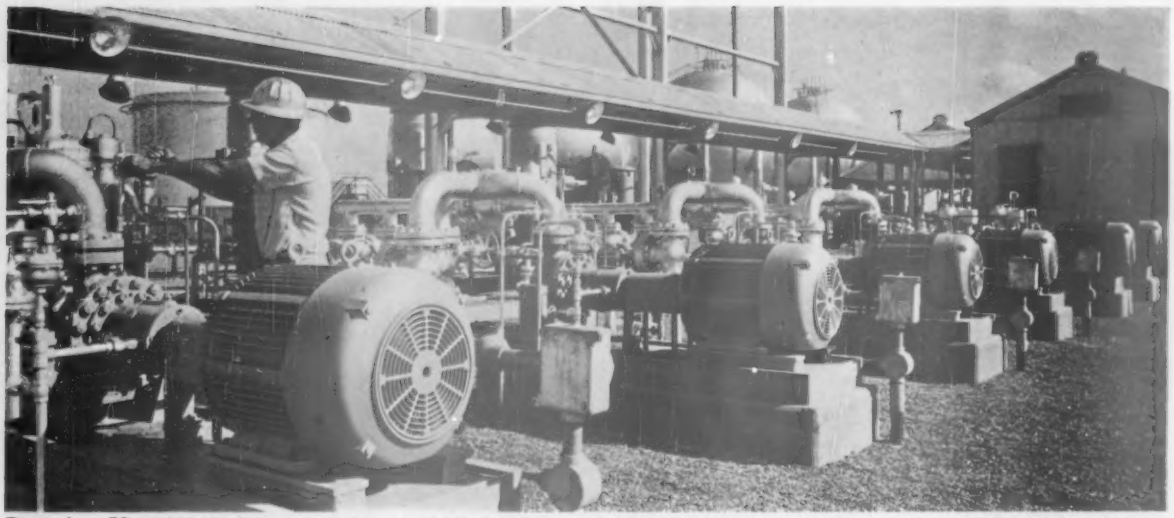
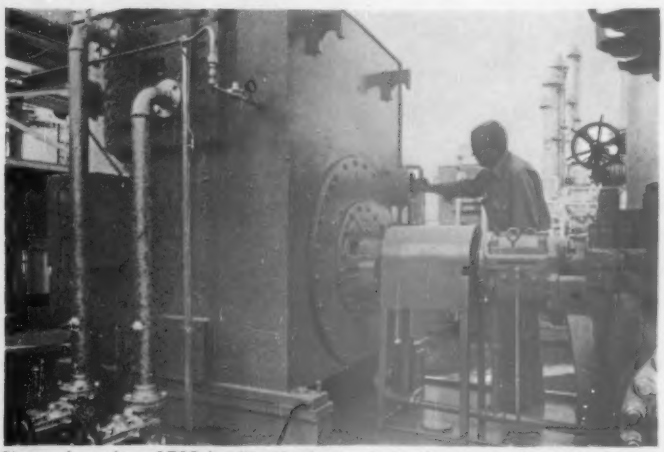
MORE (see next page)

Westinghouse reports on:

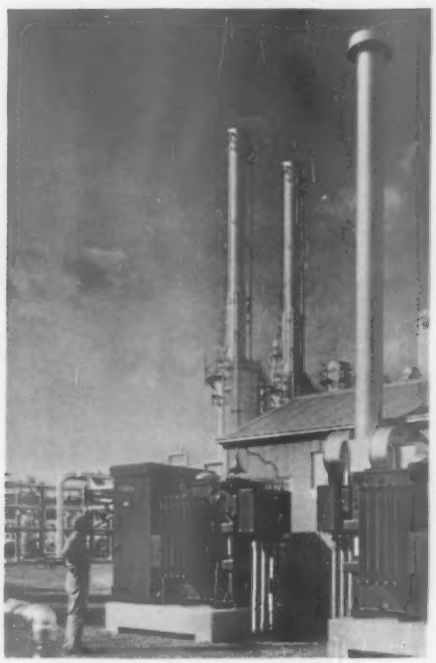
Nation's newest and largest Gas Cycling Plant



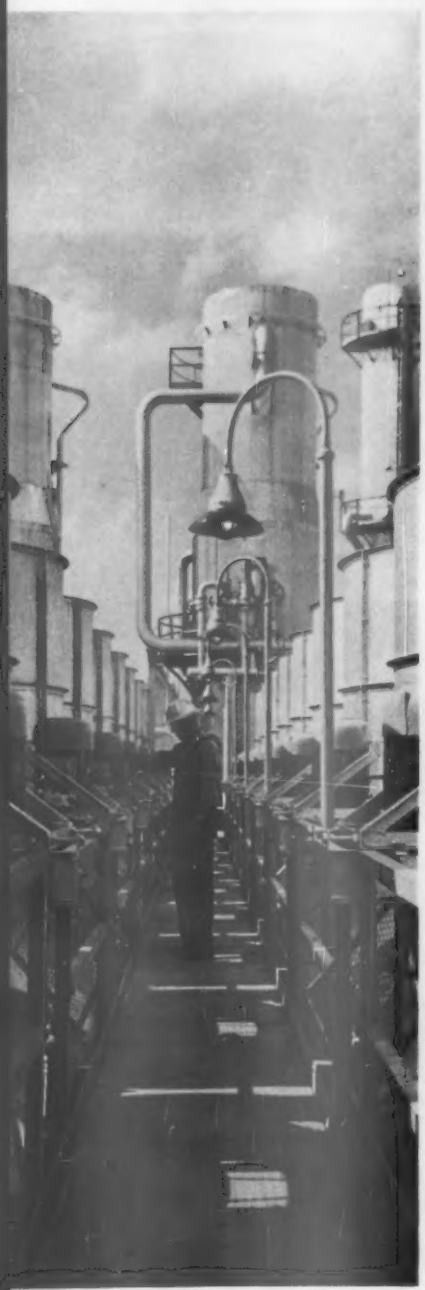
These four 75 hp Westinghouse explosion proof Life-Line® A a-c motors drive product loading pumps. At far right, two 100 hp Westinghouse a-c motors power gasoline shipping pumps.

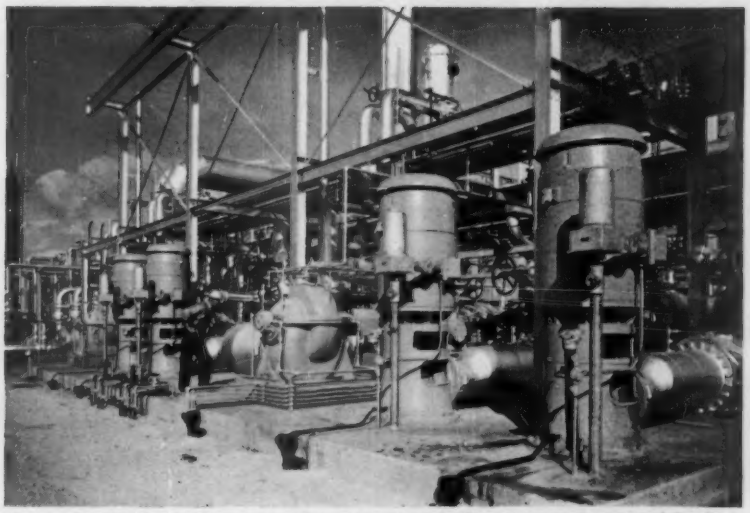


Shown here is a 1500 hp Westinghouse induction generator used in the plant's main processing area. The generator is in fact a 1500 hp 1800 rpm squirrel cage motor driven above synchronous speed by an oil line pump. Pump runs in reverse to drive motor as generator.



Pictured (right) is one of the six Westinghouse Load centers serving this large gas recycling plant. Two 1000 kva Westinghouse transformers (in foreground) supply power to injection pumps, de-ethanizer feed pumps, cooling fans and process pumps in the main processing area. J-56176-2





Pumps furnishing cooling water for product and oil coolers are powered by four vertical 200 hp explosion proof Westinghouse Life-Line® A a-c motors.

View of one of the six Westinghouse load centers employed at the plant. Panelboard includes individual controls for pumps, fans and air compressors as well as the lighting system in the compressor area.

Twenty-two large low pressure "still" condenser fans serving the main processing plant area are individually driven by 10 hp Westinghouse Life-Line® A a-c motors.

J-96176-3

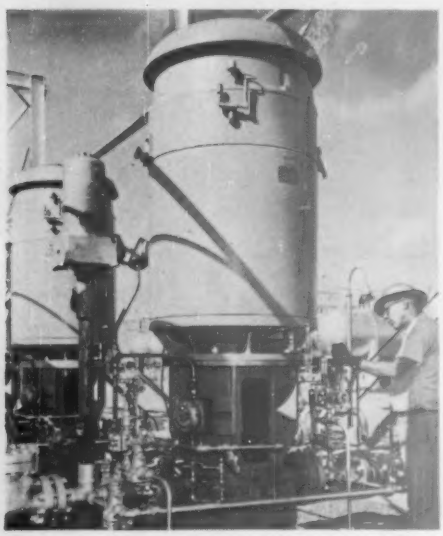
MORE (see next page)

Westinghouse reports on:

Nation's newest and largest Gas Cycling Plant

High voltage Westinghouse switchgear controls power distribution from four steam-driven turbo-generators to the six load centers at this new giant 151 acre plant in the southwest which has a maximum rated capacity of 950 million cubic feet per day.

Two of three 200 hp Westinghouse explosion proof, fan-cooled motors drive vertical pumps to pump butane via pipeline to customers in the Southwest. Two similar 300 hp motors in this same area deliver propane also by pipeline.



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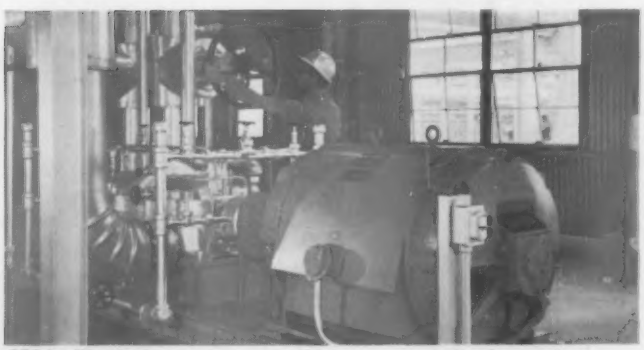


250 hp Westinghouse a-c motor which powers a boiler feed water pump.

Westinghouse: Single source for total electrical services to the industry. For information on how Westinghouse engineering services and products can help you realize major improvement in process cost and efficiencies, see your local Westinghouse sales engineer or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 22, Pa. You can be sure . . . if it's Westinghouse.

Westinghouse

Du Pont *Petroleum Chemicals* News

Number 109 in a series of bulletins for the Petroleum Industry JULY • AUGUST 1961

TWO MOVIES BARNSTORM THE COUNTRY

Oil companies tie in, to expand the demand

Now touring the country is "Down the Road," the CinemaScope featurette which co-stars the roads of America and the rich heritage they lead to.

Sponsored by Du Pont as part of the oil industry's travel-promotion program, this film is being met with applause by audiences everywhere.

In many localities, oil marketers have tied in with local showings.

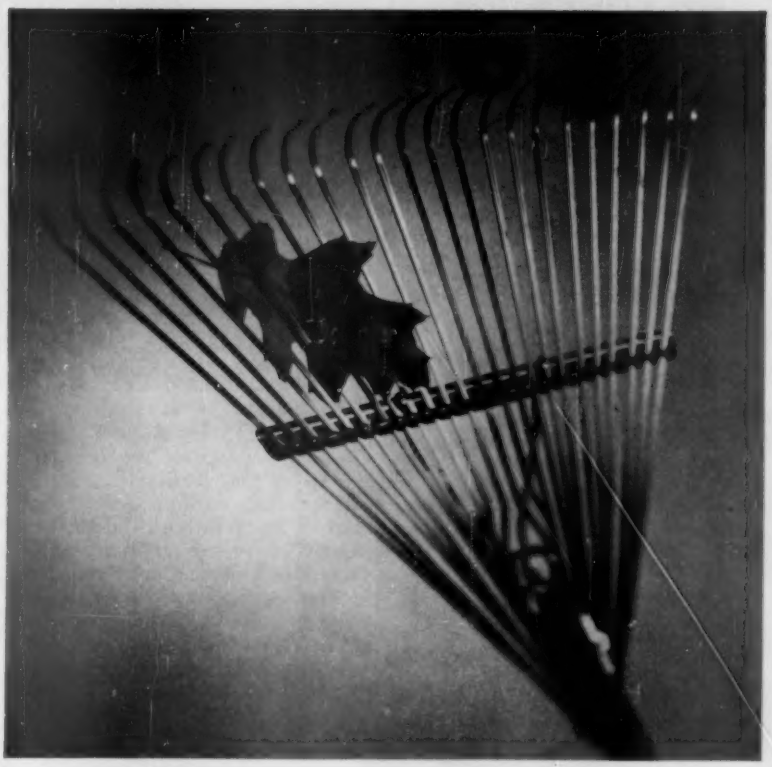
For example, in Albany, N. Y., service stations throughout the area blossomed forth with colorful posters promoting the movie. Efforts of several oil companies were carefully coordinated for this promotion by the Du Pont representative, who supplied the posters.

Your Du Pont representative can give you the playdates in your marketing area, if you are interested in running a similar promotion.

Also available is the 16-mm color movie, "Highway Holiday," a half-hour film which picks up the open-road theme of "Down the Road" and expands upon it. A number of oil companies are now using it as a part of their own travel-promotion programs.

Your Du Pont representative can arrange a showing of "Highway Holiday" for you, as well as supplying prints for showing to dealer meetings, civic groups, clubs, etc.

Both movies include scenes like this to stimulate interest in touring America.



How to sell a better fuel oil in the heating season ahead

Sometime between now and Labor Day, it can pay you to give a little extra attention to the stability of your fuel oil.

Sludge can be the source of many oil heater problems, customer complaints and loss of business. It clogs filters, plugs burner nozzles. It reduces capacity of your storage tanks (and your customers'), often creates an expensive cleanup problem.

But you can solve the sludge problem *before the heating season begins*, by adding a small quantity of Du Pont Fuel Oil Additive No. 2 to your fuel oil. Usually just 5 to 15 pounds of FOA-2 are enough to prevent sludging in 1,000 barrels of oil. Your costs are low.

FOA-2 is a solubilizer and dispersant. It prevents sludge accumulation, and can even disperse previously formed sludge.

It is a non-metallic additive. It burns completely along with the fuel, leaving no ash of its own.

Refiners have stabilized millions of barrels of heating and fuel oils with FOA-2 since its introduction ten years ago. It continues to be one of the most profitable decisions you can make to safeguard the quality of your product.

Your Du Pont Petroleum Chemicals representative has the information you need to clear up the sludge problem *before* the fall heating season sets in.

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER ▶

Du Pont *Petroleum Chemicals* News

MID-CONTINENT TECHNICAL MANAGER

CHARLES B. MILLER is Technical Manager of the Du Pont Petroleum Chemicals Division, Mid - Continent Region, headquartered in Tulsa, Oklahoma.

Mr. Miller joined Du Pont in 1941 and was first assigned to Jackson Laboratory, one of Du Pont's basic research laboratories. He has been with the Petroleum Chemicals Division since 1952. Prior to his present assignment, he held the position of Mid-Continent Regional Laboratory Manager in Tulsa and Research Chemist at the main Petroleum Laboratory located at Carneys Point, New Jersey.

Mr. Miller and his laboratory staff make available to the oil industry the expanding technical services of Du Pont. Gasoline antiknocks and additives for petroleum products are his specialty. Wide experience in the laboratory and in the field enables him to assist refiners in the selection of the proper additive product to do a job.

Mr. Miller holds a Masters degree in Chemistry from the University of Delaware.

What's the score on motorists' buying habits?

The "Summary Report" of the Du Pont "Profile of the Motorist" survey is now available. This 40-page booklet contains a concise report of the results of the most extensive survey ever made of the American motoring public.

The new publication contains the survey's answers to questions such as how people react to price-wars, give-aways, trading stamps, regular vs. premium gasolines, TBA purchases, credit cards, vacation driving — and many other findings which explain the motorist and the market he represents.

The "Profile" survey is the fourth in the Du Pont series dealing with service station marketing. The "Summary Report" contains comparisons with the earlier surveys, to give marketing groups a picture of the trends in several areas of inquiry.

Your Petroleum Chemicals Division representative will be pleased to provide you with a copy of this new publication.

New developments in continuous gasoline blending discussed in talk

The advent of electronics has dramatically changed the position of in-line blending in the oil industry.

Until recently, most refineries had to make so many changes in field piping that they could not justify the expense.

It is no longer necessary to make such extensive field piping changes. With electronic control equipment and transmission of signals as digital pulses, gasoline components no longer need be piped to a central meter station adjacent to a control room.

Not only are piping costs much lower, but there are also new savings in the size, location and installation costs of the control room and control equipment.

B. G. Crane, Manager of Operations in Du Pont's Petroleum Chemicals Division, spoke on new in-line blending developments at the annual meeting of the W.P.R.A. If you would like a transcript of Mr. Crane's talk, contact your Du Pont representative.

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OVER

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

Serial A-20427 117326

Printed in U.S.A.

WAGNER® MOTORS AT WORK

power to move petroleum to market

Cool-running Wagner® 500 hp tube ventilated motor provides explosion-proof drive for pumping crude oil from storage to tankers at sea.

Logistically complex job, moving petroleum products to market. Demands skill and know-how. Demands plenty of power, too . . . power provided, in many instances, by Wagner Tube Ventilated Motors.

But powering the pumps that start petroleum products on their way to the corner service station is just one of many jobs performed by these stamina-packed motors. They are also used as drives for big fans, blowers, compressors . . . any heavy-duty application. Built in ratings through 500 horsepower, these totally-enclosed, fan-cooled motors are tube ventilated for cooler running, longer life. Type YP, standard TEFC, or Type ZP, explosion-proof, can be supplied with Underwriters' Label for hazardous locations.

When you need motors that can operate for long periods of time without maintenance . . . that keep right on producing the power you need even under the most critical conditions, choose from these Wagner® Big Job-Rated Motors. Check with your Wagner Sales Engineer; he'll show you how they'll solve your large motor problems.

Branches and Distributors in all Principal Cities

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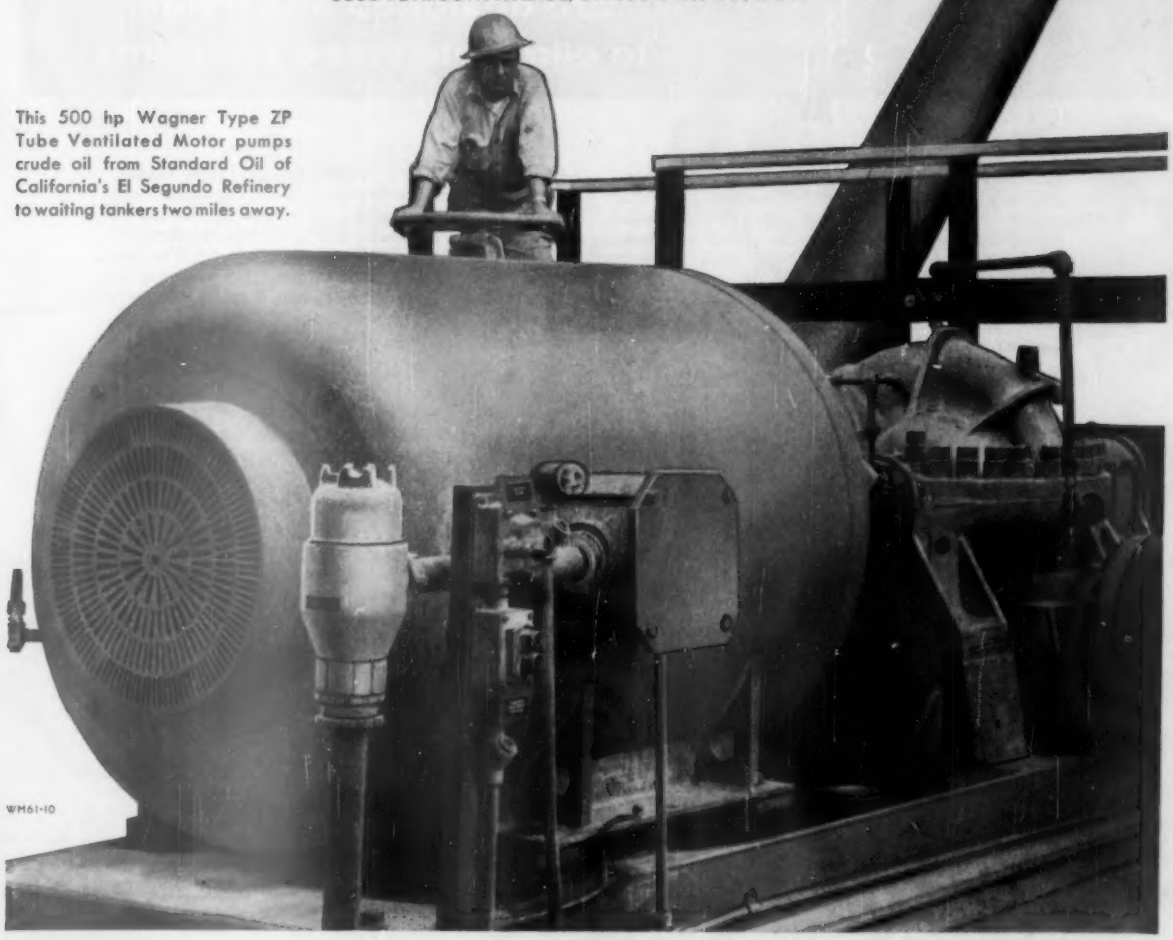
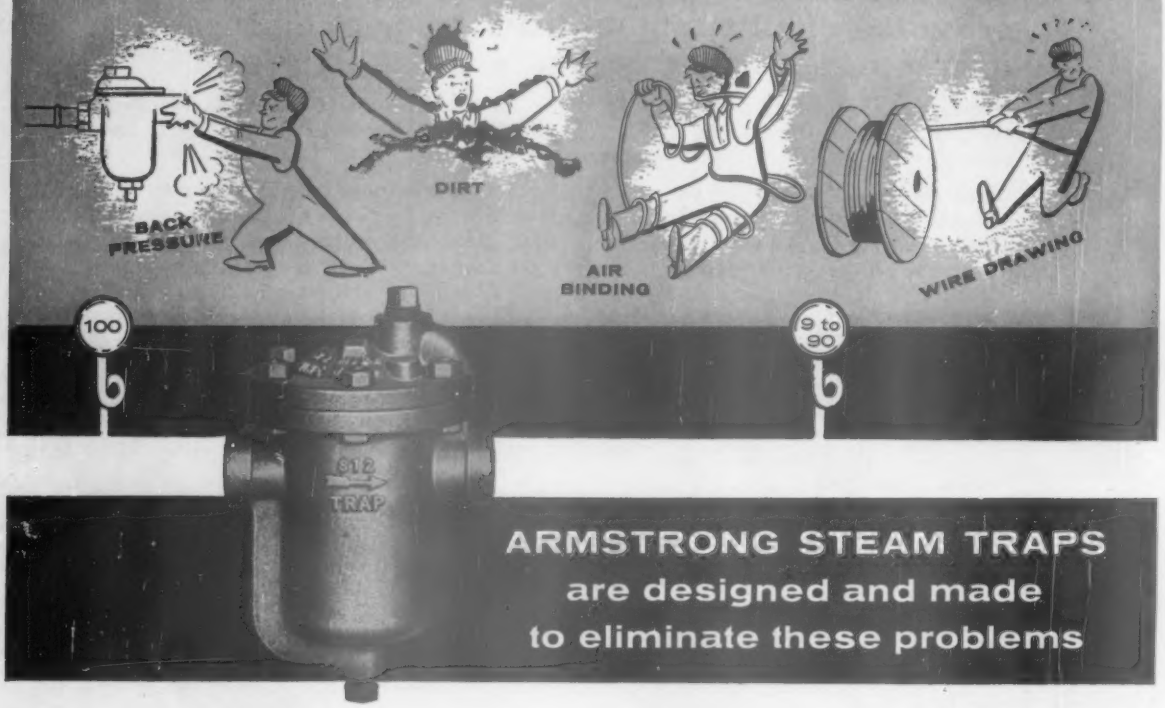


This 500 hp Wagner Type ZP Tube Ventilated Motor pumps crude oil from Standard Oil of California's El Segundo Refinery to waiting tankers two miles away.

WM61-10

Have you ever been troubled by any of these steam trap problems?



ARMSTRONG STEAM TRAPS are designed and made to eliminate these problems

BACK PRESSURE . . . Armstrong Traps operate on any back pressure—or vacuum, for that matter. As long as there is a pressure differential across the trap, it will close on steam and open for condensate. Even the high back pressure caused by blow through of one or more traps in the system will not disturb Armstrong Traps. Other than a reduction in capacity, Armstrong Traps are unaffected by back pressure.

DIRT . . . Armstrong Traps are not affected by ordinary dirt. When the trap opens condensate swirls down under the edge of the bucket and up through the discharge orifice. Dirt is kept in suspension and discharged along with the condensate. For very bad dirt conditions, Armstrong offers traps with integral strainers. These cost less than a trap plus a separate strainer.

AIR BINDING . . . Armstrong Traps cannot air bind. Air in the system passes through a vent in the top of the bucket. It collects in the top of the trap and is discharged with the condensate. There is no chance for it to stop the trap. For low pressure on-and-off units where large amounts of air accumulate while the steam is off, Armstrong offers open float and thermostatic air vent traps in a complete range of sizes.

WIRE DRAWING . . . Armstrong Traps are designed and made to resist wire drawing. The valve and seat are tough stainless steel. The valve opens and closes tightly with a fast action and is always water sealed. There is virtually no chance for grit or sediment to lodge in the valve, virtually no chance to create conditions that lead to wire drawing.

There's no need to accept any of these problems as "inevitable." Your local Armstrong Representative can show you how to end them all. Call him today or write direct.

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

ARMSTRONG MACHINE WORKS

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"A great step forward with your Planetary Gears, Big Bearings and Cylindrical Crossheads"

WHELAND PLANETARY
HP-16000 PUMP
Duplex Power Slush Pump
7¾" x 16", 600 H.P. at 65 RPM

OIL PRODUCTION MAINTENANCE, INC.
7440 CHOCOLATE BAYOU ROAD -- P. O. BOX 14291
HOUSTON 21, TEXAS
August 31, 1960

Mr. Gordon P. Street, President
The Wheland Company
Chattanooga, Tennessee

Dear Mr. Street:

Our Wheland Planetary Pump is giving us increased penetration and good savings on bits. We know from more than 18 months of constant operation on 10,000 Ft. wells that our savings are substantial.

We have kept an accurate record on operating costs and all maintenance costs and are especially impressed by the low cost of fluid end expendables. The HP-16000 Pump has constantly operated near its rated capacity on more than 200,000 feet of hole in the Texas Gulf Coast Area.

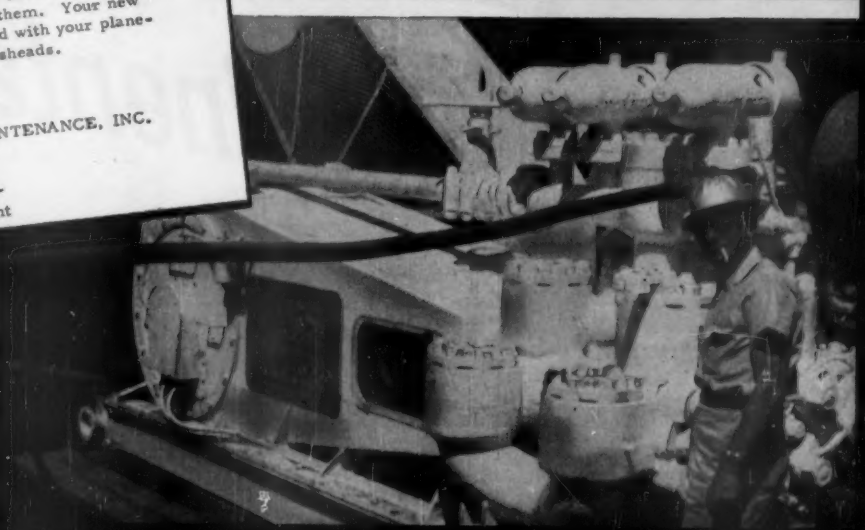
We are now operating Wheland HP-18000, HP-14000, and HP-16000 Pumps and are glad to recommend them. Your new HP-16000 Pump design is a great step forward with your planetary gears, big bearings and cylindrical crossheads.

Yours very truly,

OIL PRODUCTION MAINTENANCE, INC.

J. K. Butler

J. K. Butler, President



Wheland HP-16000 Planetary Pump owned by Oil Production Maintenance, Inc., on location in the Gulf Coast area.

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..premium quality hose.. proven through 10 years of worldwide service ..high capabilities, yet now priced no more than standard API Class C hose.

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..unbeatable as an economical hose, meeting all API Class A specifications.

☆No Price Increase

5-BAND Rotary Hose

Unique, electronic equipment forms this new, Green Triangle 5-Band Rotary Hose . . giving it outstanding characteristics. It *outperforms* the record-setting Green Triangle 3-Band Hose with *more* reserve strength, *greater* safety and *longer* operating life for *unsurpassed* rotary hose economy. Two years of extensive field tests have proven its rig reliability to be far beyond drawing-board expectations with potential strength fully equal to any drilling demands of the forseeable future.

The Green Triangle Label, as always, signifies the highest oil-field quality available. And Continental's vast, worldwide network of service points further guarantees your complete satisfaction.

Here's more news. Green Triangle 5-Band Hose costs no more than the former price of the 3-Band Hose. And the 3-Band Hose is now priced no higher than standard API Class C hose . . *an unprecedented bargain.*

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They Say—

Lacq sulfur output moves up

Dear Sir:

We have read with great interest your paper in the April 17 issue of The Oil and Gas Journal ("Recovered Sulfur's Impact on Market Is Growing," p. 70).

You know that our company owns the Lacq field, which is located in southwestern France. It seems that your information is not quite up to date.

Our production is to reach 1,400,000 tons sulfur a year, which means roughly 4,000 tons a day. The 1,000 tons a day production (p. 71) is far behind. We are running our plant at the rate of 3,500 tons per day and the rate of 4,000 tons will be reached in the next few weeks. Our last units are already started and are increasing progressively the production.

In spite of our possibilities, the European needs, which are growing very fast, exceed the 1,400,000 tons of our production. The American and Mexican producers are keeping a substantial position in these markets, which are also supplied by other European producers.

A. Charveriat
Soc. Nationale des Petroles d'Aquitaine, SA
Paris

Big difference in one letter

Dear Sir:

In the June 5, 1961 issue of The Oil and Gas Journal, you printed an article on pages 48 and 49 about the HDA hydrodealkylation process of Atlantic Refining Co., Hydrocarbon Research, Inc., and Esso Research & Engineering Co. ("Processing Briefs").

A typographical error made in this article completely reversed the sense of our agreement. The sentence as it appears in your article reads: "Techniques and know-how resulting from the development work of all three companies will not be offered in HDA license."

This sentence should read: "Techniques and know-how resulting from

the OIL AND GAS JOURNAL

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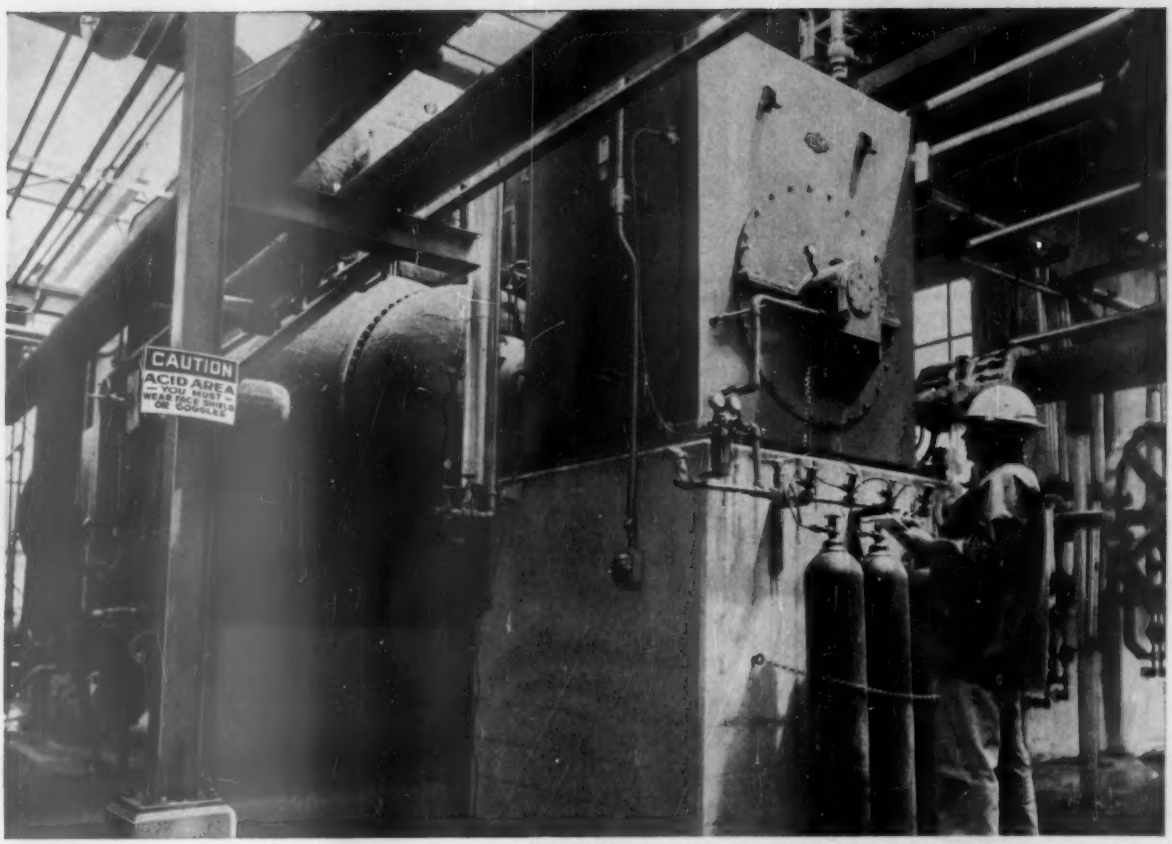

E-M TEIGF 400 hp, 585 rpm, 4600 v Squirrel-Cage Induction Motor driving contactor at Aurora Gasoline Company's Detroit refinery.

E-M's TEIGF Motor Provides Built-in Protection in Hazardous Area

"Protection for safe, reliable operation in an atmosphere of olefinic hydrocarbons and corrosive sulfuric acid."

This was the prime feature which prompted petroleum engineers at Aurora Gasoline Company to choose an E-M TEIGF (Totally-Enclosed Inert-Gas Filled) Custom-Tailored Motor to drive a large contactor at their Detroit refinery's new alkylation plant.

Here's how this built-in protection is assured in E-M's TEIGF Motor:

A low but positive pressure within the motor enclosure keeps dangerous, harmful gases out. Inert gas (nitrogen) pressure is maintained inside the enclosure at 1 to 2 inches of water above atmospheric . . . thus the motor always operates in a harmless atmosphere all its own, unaffected by ambient conditions. This means protection against the possible twin dangers of explosion and internal corrosion.

The E-M TEIGF Motor provides protection against expensive operation, too. Gas loss is lower than commercial standards. Special oil-pressure gas seals provide positive seal at shaft bearings. Seals are virtually non-wearing.

Motor maintenance is minimum . . . the motor in the photo above operates 24 hours per day, with a scheduled maintenance shutdown only once every twelve months.

Built-in protection, economical operation, minimum maintenance . . . it all adds up to an outstanding motor drive for this hazardous area.

Learn more about E-M TEIGF Motors now. Our application specialists will tailor a unit to fill *your* specific needs. Contact your nearest E-M Sales Engineer for TEIGF Motor Bulletin No. 226, or write to Electric Machinery Mfg. Company, Minneapolis 13, Minnesota.

Specialists in making motors do exactly what you want them to

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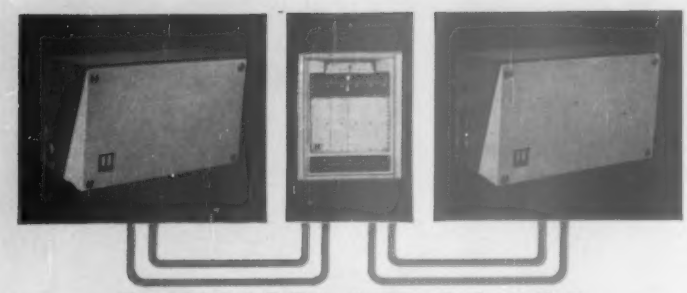


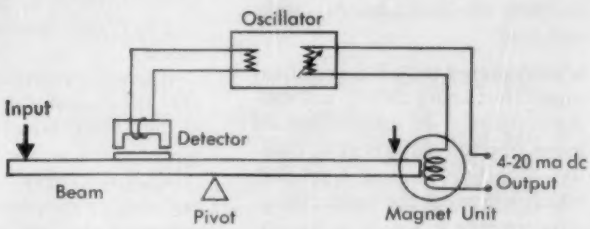
***ElectriK Tel-O-Set*—the true 2-wire system**

Care and feedback of delicate inputs

Delicate inputs thrive on the tender care of *ElectriK Tel-O-Set's force-balance feedback system*. This system, used as the basic circuit in *Tel-O-Set* transmitters, receivers, controllers, and other instruments, has proved itself in thousands of installations in the last five years. The force-balance feedback circuit increases the accuracy and dynamic response of the system by decreasing hysteresis effects and sensitivity to changes in ambient conditions.

Observe: (1) input force (from bellows, Bourdon tube, or displacement linkage) deflects pivoted beam; (2) air-gap in ferrite detector increases, (3) producing a change in inductance in oscillator circuit; (4) a portion of output current is fed back into magnet unit, producing a force on beam which is equal and opposite to input force; feedback balances beam. Full scale motion is only one-thousandth of an inch.

The advanced control engineering seen in force-balance feedback is carried through the entire *ElectriK Tel-O-Set* System. Specifically, there's no external power required at any field-mounted *Tel-O-Set* instrument. Line power connection is made only at the receiver. Two-wire d-c transmission eliminates shielding problems. The 4-20 milliamp signal range of the system gives a live zero and permits the use of the most reliable transistors available. The d-c signals



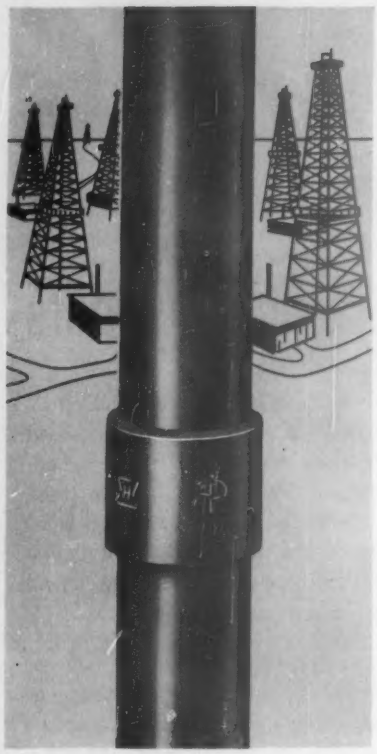
can be fed into data handling systems and millivolt-actuated instruments . . . can be easily transduced to a standard 3-15 psi pneumatic signal to operate existing pneumatic systems.

Take a new look at your control applications with the *ElectriK Tel-O-Set* System in mind! Get complete technical data from your local Honeywell field engineer. Call him today . . . he's as near as your phone. MINNEAPOLIS-HONEYWELL, 21 Penn Street, Fall River, Massachusetts.

Honeywell

First in Control

SINCE 1885



HARRISBURG COUPLINGS

FOR OIL DRILLING AND WHEREVER PIPE COUPLINGS ARE USED Harrisburg Steel has been well-known for many years — well known for high quality seamless steel couplings — of strength and accuracy — with threads unexcelled in correctness of form, height, angle and lead.

Manufactured to A.P.I. specifications, Harrisburg tubing and casing couplings are under constant inspection for uniformity of quality — to bring to you a product which will meet the most critical requirements.

FOR ALL TYPES OF COUPLINGS Specify Harrisburg.

HARRISBURG STEEL CO.

Division of HARSCO CORPORATION
HARRISBURG 6, PENNSYLVANIA

the development work of all three companies will now be offered in HDA license."

Because your article as it appeared with the error will be confusing to the reading public with respect to our position in HDA licensing, we would greatly appreciate your printing a correction.

Charles C. King
Vice President
Hydrocarbon Research, Inc.
New York

New reserves in old fields

Dear Sir:

The article, "Ancient Fields Still Adding to Reserves," in the May 29 issue (p. 101) has me perturbed somewhat.

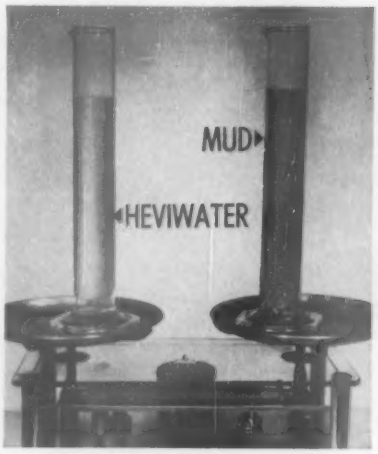
It may leave the impression in many readers' minds that once development is complete in any given field, there are just bound to follow constant revisions, most of them upward, of previous reserve estimates. So, the longer one waits the more reserves he will see assigned to any given field. Such an impression would, of course, be erroneous, although a study of the histories of many large fields may indicate some validity for such a general statement.

Why are there seemingly constant upward revisions in reserve estimates for the large fields? The NPC report lists several reasons, including enlargement of a field by subsequent exploratory drilling. This, in my experience, is the most important single cause for upward revision in field reserves and I would have liked to have seen more emphasis given to it, both in the NPC report and particularly in your article.

It must be remembered that probably the majority of the large fields in the United States contain several pay horizons or reservoirs. After the year of discovery of one reservoir and after development appears to be complete, the field is subject to enlargement not only in that one reservoir but also to discovery of additional reservoirs. Thus, the field may be extended both vertically and laterally.

To avoid confusion and to keep our records straight in regard to reserve estimates, a system of reporting by reservoirs (or at least the major reservoirs) should be strictly adhered to, both by the compiling

HEVIWATER
completion fluid
avoids use of mud



Since inhibited Heviwater* is free of solids, it helps operators avoid problems such as pay contamination and the sticking of packers due to the settling out of solids.

Heviwater can be furnished pre-mixed or it can be mixed at the well site using rig equipment. Dowell supervision for mixing is available upon request at no cost.

This table shows the materials which can be used, in addition to fresh water and corrosion inhibitors, to provide various fluid weights of Heviwater:

FLUID WEIGHT (LBS/GAL)	MATERIALS USED
8.33-10.0	NaCl
8.33-11.0	NaCl + $CaCl_2$
8.33-11.8	$CaCl_2$
11.8 -14.0	$CaCl_2$ + $ZnCl_2$

Heviwater can be made available wherever this type of completion fluid is needed. Ask your Dowell representative for full information. *DOWELL TRADEMARK

PRODUCTS FOR THE OIL & GAS INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

MATHIESON
Sulfuric Acid

H_2SO_4

ECONOMIC ANALYSIS

Reliable cost figures depend on many factors relating to your individual location and requirements. Part of Mathieson's responsibility is the development of realistic figures for you in this area.

DEPENDABLE SUPPLY

Strategic locations assure you fast delivery of all commercial grades of sulfuric acid from our plants and shipping points in Beaumont, Port Arthur, Pasadena, Texas ... Little Rock, Ark. ... Bossier City, La. ... Baltimore, Md.

ACID RECOVERY

Dependable outlets for spent acid can be as important as acid supply. Olin Mathieson's long experience in spent acid handling determines our recommendations for the most advantageous disposal of your spent material.

SAFETY

New operations, new employees ... you will need complete safety and handling instructions. We supply these in both literature and wall chart form.

TECHNICAL ASSISTANCE

Your Olin Mathieson man knows the petroleum field and the chemical industry. His on-the-spot knowledge and our laboratory facilities and experience are at your disposal. For product specifications or service, call or write: OLIN MATHIESON, Balto., 3, Md.

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Olin
CHEMICALS DIVISION

8956

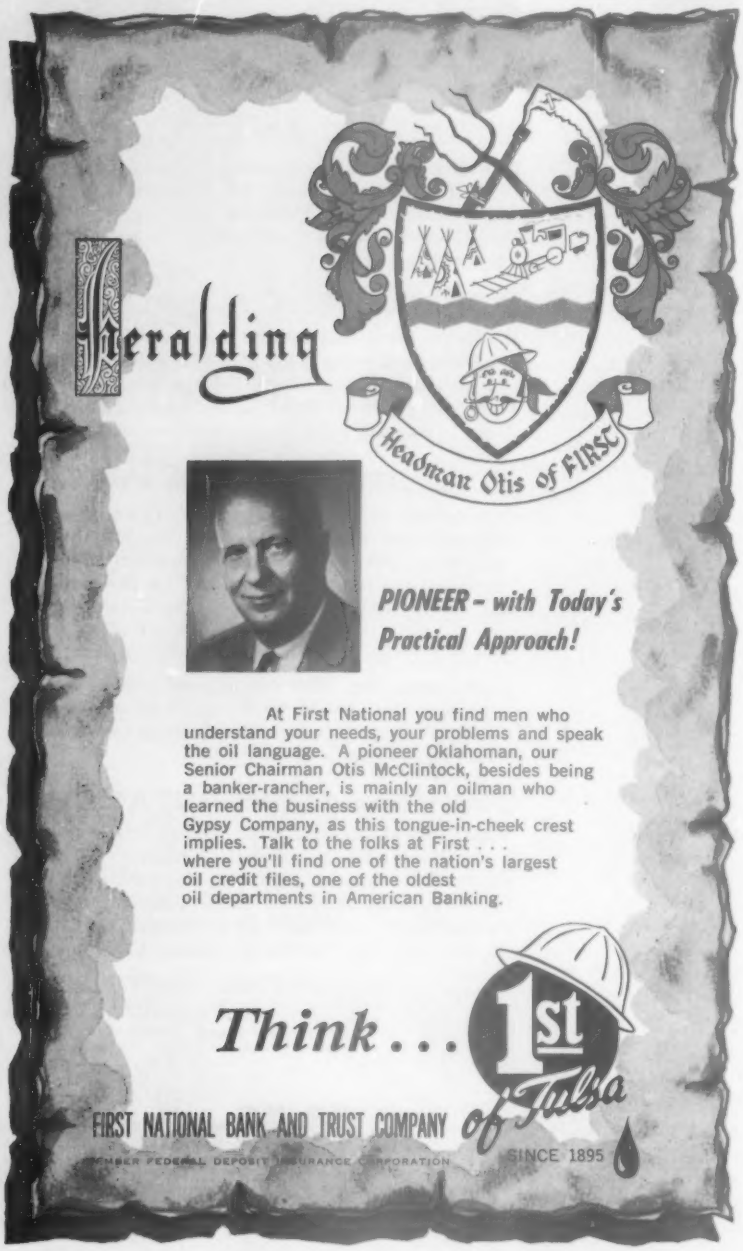
groups and by those who report on their findings.

Alton J. Carroll
Houston

History shows that we have consistently underestimated reserves of our ancient oil fields. As one example, the old Bradford field of Pennsylvania and New York has continually surprised us with its productivity.

One basic reason for these constant upward revisions is, of course, deeper drilling and outpost drilling and even "shallower" drilling. But even more important are the miracles of secondary recovery and improved methods of production and exploitation. Also, new techniques such as fracturing have made profitable pools out of field fringes that were previously written off, and opened tight reservoirs that could never have been produced without these techniques.—Ed.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.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CALENDAR

JULY

- 4-7 National Society of Professional Engineers, twenty-seventh annual meeting, Olympic Hotel, Seattle.
- 6-8 International Oil Scouts Association, annual meeting, Roosevelt Hotel, New Orleans.
- 10-21 University of Michigan, summer course on underground storage of natural gas, Ann Arbor, Mich.
- 23-28 National Congress of Petroleum Retailers, annual session, Cosmopolitan Hotel, Denver.
- 26-28 American Petroleum Institute, Division of Production, eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.
- 27-29 Rocky Mountain Mineral Law Foundation, seventh annual institute, University of New Mexico, Albuquerque.

AUGUST

- 2-4 Wyoming Geological Association, sixteenth annual field conference, Green River, Wind River, and Powder River basins.
- 20-22 North Dakota Oil and Gas Association, ninth annual meeting, Plainsman Hotel, Williston, N. D.
- 20-24 Asphalt Institute, international conference on structural design of asphalt pavements, University of Michigan, Ann Arbor.
- 28-30 Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.
- 28-Sept. 1 American Society of Mechanical Engineers, international heat transfer conference, Boulder, Colo.

SEPTEMBER

- 5-8 American Chemical Society, Chicago section, eleventh national chemical exposition, International Amphitheatre, Chicago.
- 7-8 Rocky Mountain Association of Geologists, field conference, Salida, Monarch, Ouray, Silverton, and Durango, Colo., areas.
- 7-9 Magic Plains Oil Exposition, Borger, Tex.
- 11-15 Instrument Society of America, fall instrument - automation conference and exhibit and sixteenth annual meeting, Biltmore Hotel and Memorial Sports Arena, Los Angeles.
- 12-13 American Gas Association, Southern Gas Association, annual accident prevention conference, Statler Hilton Hotel, Dallas.
- 13-15 Pacific Coast Gas Association, convention and annual meeting, Coronado Hotel, Coronado, Calif.
- 13-15 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.
- 13-15 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.
- 14 Natural Gasoline Association of America, Rocky Mountain regional meeting, Northern Hotel, Billings, Mont.
- 15-16 Kansas Geological Society, annual field conference, Mark Twain Hotel, Hannibal, Mo.
- 17-20 American Institute of Electrical Engineers, annual electrical conference of the petroleum industry, Jung Hotel, New Orleans.
- 18-19 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

20-21 American Institute of Electrical Engineers, Institute of Radio Engineers, Instrument Society of America, industrial electronics symposium, Bradford Hotel, Boston.

20-21 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-27 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Muehlebach Hotel, Kansas City.

24-27 American Institute of Chemical Engineers, national meeting, Lake Placid Club, Lake Placid, N. Y.

25-27 Texas Mid-Continent Oil and Gas Association, annual meeting, Texas Hotel, Fort Worth.

25-28 American Welding Society, fall meeting, Adolphus Hotel, Dallas.

OCTOBER

1-4 American Gas Association, annual convention, Dallas.

3-4 University of Kansas, ninth annual gas measurement institute, National Guard Armory, Liberal, Kans.

4-6 American Association of Oilwell Drilling Contractors, annual meeting, Rice Hotel, Houston.

4-6 American Society of Mechanical Engineers, process-industries conference, Shamrock-Hilton Hotel, Houston.

8-11 Society of Petroleum Engineers of AIME, annual fall meeting, Memorial Auditorium, Dallas.

11-12 Western Petroleum Refiners Association, waste disposal and stream pollution conference, Hotel Lassen, Wichita.

12-13 California Natural Gasoline Association, annual fall meeting, Lafayette Hotel, Long Beach, Calif.

15-17 National Association of Oil Equipment Jobbers, annual convention and trade show, Mayflower Hotel, Washington.

15-18 American Petroleum Credit Association, annual conference, Shamrock-Hilton Hotel, Houston.

17-19 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Morrison Hotel, Chicago.

18-20 Rocky Mountain Oil and Gas Association, annual convention, Denver-Hilton Hotel, Denver.

18-21 American Association of Petroleum Geologists, Mid-Continent regional meeting, Amarillo, Tex.

24-25 Pennsylvania Grade Crude Oil Association and Pennsylvania State University Mineral Industries Experiment Station, technical conference on oil recovery by solvents, Pennsylvania State University campus, University Park.

24-27 National Association of Corrosion Engineers, south-central region conference and exhibition, Shamrock-Hilton Hotel, Houston.

25-26 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

25-27 Gulf Coast Association of Geological Societies, annual meeting, Granada Hotel, San Antonio, Tex.

27 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

29-31 Independent Petroleum Association of America, annual meeting, Shamrock-Hilton Hotel, Houston.

29-Nov. 1 National Lubricating Grease Institute, annual meeting, Rice Hotel, Houston.

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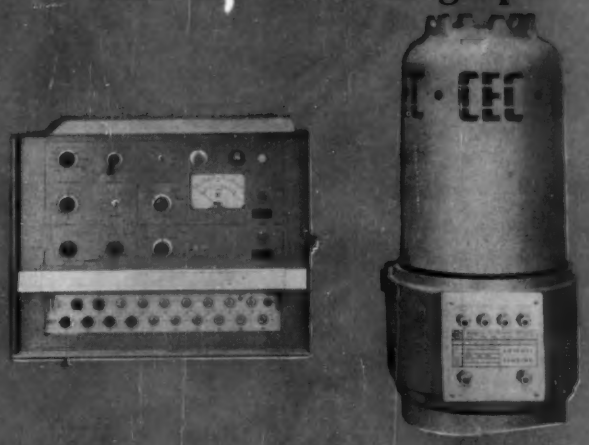

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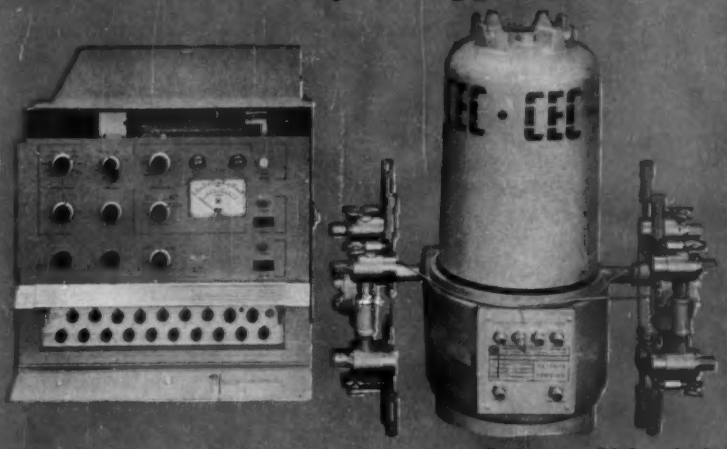

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the Journal said...

50 years ago

July 6, 1911

Sustained temperatures above 110° in the Mid-Continent area have led Prairie Oil & Gas Co. to install ice plants at all its pumping stations. Ice will be supplied all company employes.

Arrival at Sabine Pass, Tex., of a shipment of Mexican crude oil is creating considerable concern among independent producers of fuel oil in the Gulf Coast region. Gulf Coast producers fear this duty-free oil may be the forerunner of a flood of crude to be brought into this country at low cost with continued expansion of Mexico's new flush fields.

25 years ago

July 2, 1936

Standard Oil Co., of California and the Texas Corp. form the California Texas Oil Co., Ltd., as a jointly owned marketing unit to operate in the Far East. It reflects a growing trend on the part of certain major domestic companies to strengthen their positions in foreign fields and markets.

New Madison lime oil and gas well drilled by Turner Valley Royalties, Ltd., in west-flank extension area of Turner Valley field, 40 miles southwest of Calgary, Alta., blows in as deepest producer in British Empire, and largest producer drilled in Canada since the famous Oil Springs gushers of 1862. Flow is estimated at 1,000 bbl. daily from depth of 6,824 ft.

10 years ago

July 5, 1951

New well at Weeks Island salt dome in Iberia Parish, Louisiana Gulf Coast, becomes world's deepest oil producer. Shell Oil Co. 1 Gonsoulin flows 188 bbl. daily from sand at 16,572-16,600 ft. It takes the record from Standard Oil Co. of California 5 Mushrush, in Wasco field, California, which produces from depth of 15,530 ft.

First LPG products move from giant gasoline plant at Snyder, in Scurry County, Texas. Newly completed plant, built by Sunray (Sunray Mid-Continent) Oil Corp. as operator for 30 companies and 60 individual coowners, starts processing gas gathered from 850 wells on 35,000 acres in Kelly-Snyder area.

Gilmore Refineries, Inc., picks Odessa as site for "first California refinery to be built in Texas." Projected 25,000-bbl. plant to cost $20,000,000. Pacific Pipe Line Co. to build 24-in. crude line paralleling 16-in. and 12¾-in. products line from Odessa to Los Angeles Harbor area.

JOURNALLY SPEAKING

Silly Business

WE FEEL just awfully sorry for refiners. The poor chaps can't make any money these days on account of all the gasoline price wars that have been raging all spring.

The rest of the industry really should shed a tear for their sad plight. The least they should get is sympathy, because they are absolutely helpless to remedy their condition.

The basic cause of their woe is that they run more crude than is required by the demands of the market. This produces more gasoline than they can sell through their normal channels of distribution.

But of course they can't help this. They have to keep their runs high in order to get the benefit of the incremental barrels. If they reduced their throughput their manufacturing cost per gallon would go up, and this would be a sign of inefficiency and look bad on the balance sheet. Besides, they're losing money as it is, and this is no time to let costs increase.

So they have this extra gasoline, see, so they sell it to anybody who will take it. Since it is all incremental barrels and didn't cost them much to make, they can afford to sell it at less than their normal price. This is completely logical, and good business practice, as anyone can appreciate.

The trouble is that after this surplus gasoline leaves the refiner's control it somehow or other falls into the hands of some dirty skunk of a price cutter, say an independent marketer. He is a shortsighted citizen who is only looking out for his own business and doesn't seem to care a hang about the national welfare as reflected in refiners' profits.

So in order to get rid of his extra supply of low-cost gasoline, this marketer cuts the price at his filling stations. Naturally the refiners have to meet this low price at their own filling stations, because to allow oneself to be undersold just isn't done; it would be a sign of weakness; nobody wants to be known as a quitter in anything, particularly in a price war.

This would be bad enough, but it is compounded by something known as dealer protection. The refiner guarantees a certain profit per gallon to dealers handling his brand. This permits the dealer to lower his price as much as he wants to in order to compete with those nasty price cutters.

An example of how this works is the recent price war in Charlotte, N. C. Dealers in major-brand gasoline are guaranteed a margin of 4.4 cents per gallon. The price kept going down until it reached 4.9 cents per gallon (exclusive of tax) delivered to the service station. The dealer got his customary 4.4 cents, and the refiner got only 0.5 cent.

Then the service-station price went down to 2.9 cents, which meant that with every truckload delivered the refiner sent along a check for 1.5 cents per gallon to compensate the dealer for giving the stuff away.

To us that would seem like a silly way to do business, but of course we're not a marketing expert so we have no right to criticize. Those policies are set by the top executives of major oil companies who must be assumed to be real smart businessmen and know exactly what they are doing. If there were any way they could help themselves we're sure they would do it.

It is well known that a good refiner's margin is essential to the health of the entire oil industry. So since the refiners can't keep their margin up, maybe the rest of the industry should pitch in and help.

One way would be for crude producers to guarantee a refiner's margin. Then when his retail gasoline price goes down, producers would cut their crude price by the same amount. And if the gasoline price goes way down, the producer would pay the refiner to take his crude—thus protecting the refiner's margin and maintaining the producer's volume of crude sales.

This may seem silly, too, but it's no sillier than the way the big, smart companies handle the gasoline business.

—Henry D. Ralph.

The weld you spread with a knife

Do you still weld shoes and collars to casing?

Bakerlok makes a stronger (and safer) joint -and at lower cost

Operators tell us that once you've used Bakerlok to lock shoes and collars to casing, you don't want to work without it.

Bakerlok makes a stronger casing joint than tack welding, and does it for a lot less money.

And note this: Bakerlok makes a safer joint, too. It doesn't weaken your casing as arc-welding sometimes does. Most operators are using Bakerlok on the strength of this point alone.

These are not mere claims. Thousands of successful field runs prove Bakerlok's success beyond any doubt whatever.

Why Baker Recommends Bakerlok

Bakerlok was developed to help operators get the best possible service out of Baker casing shoes and collars. Our interest is natural, since Baker is the world's largest manufacturer of shoes and collars. In Baker's opinion, arc-welding is not a satisfactory way to lock shoes and collars to casing. Bakerlok does everything welding does, does it faster, and does it without the harmful weakening effect of arc heat on high-grade steel casing.

Apply Bakerlok with putty knife to first ⅔ of pin threads only. 8 ounce can locks six 5½" joints.

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Bakerlok kit contains 8 ounce can of compound, activator, and putty knife. Kit is available at supply stores all across the country.

Get the important facts on Bakerlok from Baker Catalog Supplement 356. Write Baker Oil Tools, Inc., P.O. Box 2274, Los Angeles 54, California.

FPC doesn't even know what gas is

A PRIME EXAMPLE of bureaucracy gone haywire is the Federal Power Commission's set of proposed rules (R-199 and R-200) to "standardize" the provisions of gas-purchase contracts.

On the assumption that pipelines can't be trusted to make intelligent deals, FPC is substituting ivory-tower decrees for the common sense and business judgment of practical operating gas men.

UNIFORM ARBITRARY DEDUCTIONS from the contract price would be required for every variation below FPC's standards of B.t.u. content, pressure, moisture, purity, etc.

This ignores the fact that many field prices are now low because these factors have already been taken into account in the contract price. Thus a double penalty would be imposed. On the other hand, a pipeline would be forbidden to pay a premium price for premium-quality gas.

Also ignored is the fact that pipelines have their own individual standards of gas quality and know what they are doing when they pay different prices for different B.t.u. content, pressure, or gas-liquid content. FPC proposes to fit them all into its Procrustean bed. For instance, no gas could be bought at less than 500 psi. in the future.

Ignorance of technical definitions and conditions is evident throughout the rules. For example, a pipeline would be prohibited from buying gas with more than 0.2 gal. per M.c.f. of "liquefiable hydrocarbons." Since all gas is liquefiable, the pipelines would be out of business completely.

Likewise flat deductions would be made for gathering, compressing, dehydrating, desulfurizing, and other operations, regardless of actual cost. One provision might force producers to build their own gathering systems.

The rules limiting the rate of withdrawal from a reservoir and restricting the application of take-or-pay clauses will play havoc with the financing and operating plans of both producers and pipelines. Some producers estimate they will increase producing costs by 4 cents per M.c.f.

In many, many other ways the proposed rules would disrupt established practices and set aside contract provisions which both parties consider fair. In their place would be unrealistic and impractical requirements based on nothing but some bureaucrat's notion.

THE INDUSTRY APPLAUDED when FPC said it favored a "commodity approach" in place of utility-type regulation. The new Harris bill would direct FPC to regulate gas as a commodity.

But if this is FPC's idea of commodity approach, industry should back off fast. For here FPC is trying to reconstitute gas the way it thinks it ought to be rather than recognizing the peculiarities of this commodity as it actually exists in nature and in commerce.

Unless and until FPC gets out of its theoretical fog of Cloud Nine and accepts the realities of the business world, it can't be trusted to regulate sensibly no matter what instructions Congress may give it.

If you formulate or use paraffin coatings...

Charts like these have been plotted for 18 ternary (3-component) systems containing two Epolene resins (E-10, E-11, E-12, N-10, N-11, N-12, C-10) and a standard 130° AMP paraffin. In each system, the tensile strength and adhesion ratings are given for combinations of the two Epolene resins varying from 0 to 2%.

Eastman can help you achieve optimum performance with the right blend of polyolefin modifying resins

A paraffin coating formulation containing a combination of polyolefin modifying resins, rather than one resin alone, will most often provide the optimum balance between such important coating properties as tensile strength and adhesion.

To aid you in obtaining optimum properties for specific paraffin coating applications, Eastman offers seven basic types of low-molecular-weight polyolefin resins.

The properties of hundreds of paraffin-polyolefin blends have been precisely determined by our chemists. Much of this information is now available in a series of easy-to-use charts. Your local Eastman representative will be glad to bring over these charts and help you find the most efficient and economical combination of paraffin and Epolene for your requirements. Call him in and see how helpful he and his charts can be.

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What the Alberta Conservation Board APPROVED and DISAPPROVED

Westalta: 900-mile, integrated 4-16-in. gathering system. Would deliver liquids to Foothills near U. S. boundary.

Foothills: 1-mile line to take Westalta products and deliver across the border to Dakota-Eastern.

Dakota-Eastern: 1,477-mile line to move Westalta products to Standard Oil Co. (Ind.) in Chicago. Total cost of three projects: $130,000,000.

Britamoil: Line to move Pincher Creek liquids to Calgary.

Provincial: Central line from Pincher Creek to Edmonton, with laterals to all existing or anticipated plants. Sixteen sections, 4-16-in. Cost: $25,000,000.

Hydrocarbons: Central system similar to Provincial. Would connect plants to Hughenden storage area and with Interprovincial Pipeline. Cost: $17,700,000.

Alberta Outlines Gas-Liquids Policy

• Conservation officials recommend a go-slow approach, with limited exports and a build-as-needed plan. Approved: Three small systems. Rejected: Three large gathering systems and a plan to move product to Chicago.

ALBERTA should reject sudden, large-scale export of natural-gas liquids to Chicago in favor of gradual development of existing and new Canadian and U. S. markets.

This concept requires the construction of small, individual gathering and truck lines as needed rather than comprehensive provincial grid systems that have been proposed.

This is the gist of the recommendation of the Alberta Oil and Gas Conservation Board to Premier Manning's government.

A quick decision is needed if approved projects are to be built by this fall. That's when surplus butane, propane, and condensate will become available on completion of several plants to process gas for export to western U. S. Manning has the discretion to modify or reverse the recommendations if he deems it in the best interests of the province to do so.

Significance of report . . . In denying the proposed Chicago export project of Pembina Pipe Line, Ltd., and Standard Oil Co. (Ind.), the board apparently set these policies:

. . . A go-slow approach on exports is necessary if Canada is to maintain its exemption from U. S. import controls. This decision was made against the background of Interior Secretary Stewart Udall's warnings of a crackdown in case of a sudden flood of Canadian supplies into a new U. S. market—such as Chicago.

Removal of Canada's exemption could wreck its national oil policy. The government is counting on exports to provide half of a proposed 250,000-bbl. daily increase in production over the next 3 years.

. . . Available supplies of natural-gas liquids will not be sufficient at first to warrant large-scale export without depriving Alberta and other Canadian markets of them. Condensate with high gasoline yield is a particularly valuable feed stock for prairie refineries, which have seen natural gas cut into fuel-oil markets, just as is the case in Chicago.

. . . The comprehensive grid-system approach to gathering liquids for the entire province is not practicable.

. . . No single purchaser-processor-marketer (especially a non-Can-

adian) should have a dominant influence in natural-gas liquids development and disposition in Alberta.

What was approved . . . The board recommended approval of these projects:

. . . Britamoil Pipe Line Co., Ltd., an affiliate of British American Oil Co., Ltd., a 64-in. line from the BA-operated Rimbey gas plant to the company's Calgary refinery.

. . . Royalite Oil Co., Ltd., a 26-mile, 4 in. extension of its existing system to move natural gasolines and condensate to the Calgary refining area from the Jumping Pound plant and one under construction in Wildcat Hills field.

. . . Hudson's Bay Oil and Gas Co., Ltd., and the affiliated Aurora Pipe Line Co., an 11-mile, 4-in. line from Waterton to Pincher Creek, and a 30-mile 8-in. line from there to the U. S. border near Carway, Alta.

The line would deliver condensate from the Pincher Creek, Waterton, and Lookout Butte fields into the affiliated Continental Pipe Line Co. system in Montana with interconnections through Platte Pipe Line to western and midwestern markets.

Initial export of 10,000 bbl. daily by Hudson's Bay is an indication of what the Alberta board considers to be within the spirit of the U. S. imports-control program. Ultimate capacity of the system is 31,000 bbl. daily.

Shell Oil Co. of Canada, Ltd., has agreed to sell to Hudson's or to transport on its own account through the line 4,000 bbl. daily of condensate from Waterton. Continental has agreed to purchase up to 10,000 bbl. daily of condensates for its own use.

The National Energy Board still must approve the export facilities. Also, Aurora Pipe Line Co. must obtain a federal charter from Parliament. And the project, with its U. S. connections, has become a political football subjected to parliamentary delays.

Disapproved . . . The board turned thumbs down on three major projects which could have cost more than $170 million while it approved the three involving only a little over $4 million.

Biggest project rejected was the ambitious joint venture of Pembina Pipe Line, Ltd., and Standard Oil Co. (Ind.).

These companies, through Westalta, Foothills Pipe Lines, and Dakota-Eastern, sought to build an extensive gathering system and a long-distance pipeline to move 50,000 bbl. of gas liquids daily into Chicago. The volume would increase to 160,000 bbl. daily by 1976.

The other two big projects not recommended:

. . . Provincial Products Pipe Lines. This envisioned a $25 million outlay for system running from Pincher Creek to Edmonton and which would connect with all present or planned processing plants (OGJ, July 18, '60, p. 57).

. . . Hydrocarbons Pipeline, Ltd. This $17.7 million project would also begin at Pincher Creek and cover generally the same area as the Provincial system.

Also turned down was a smaller project proposed by Britamoil. This would have been a line to move Pincher Creek products to Calgary. The board explained that the Hudson's Bay project would handle the same liquids and offers a "more logical market" for them.

Reasons for rejection . . . In all cases except the small Britamoil project, the board gave these reasons for disapproving the projects:

. . . The board does not believe an integrated natural-gas-liquids gathering system would best serve the interests of consumers within Alberta, nor, for the surplus volumes available, producers seeking markets beyond Alberta.

. . . Each system is overdesigned for the volumes of product available.

. . . None of the applicants is the owner of natural-gas liquids, nor does it have contracts with the owners of product for the purchase or transport of the liquids.

. . . The project as proposed is not economically feasible.

In the case of the Pembina-Indiana Standard project, the board said: "The design of the system is predicated on large-scale movements southeastward from Calgary and is not suitable for the marketing pattern anticipated by the board."

It also said it had made a comprehensive study of the availability of natural-gas liquids available in the future. It found, it said, that there should be about 20,000 bbl. daily available for the Chicago system in 1962 and that this volume should rise to about 44,000 bbl. daily in 1966.

This, it said, is far below the volumes needed to make economical the project to serve refiners in the Chicago area.

The board also objected to giving such a dominating position to a nonproducer. It said: "The board believes it less than desirable in the public interest that Standard, who would be a single purchaser-processor-marketer with no direct interest as a producer in the province, should have the degree of influence which the board is confident would result."

Normanna Case Rehearing Denied Again

THE monkey is now on the Texas Railroad Commission's back in the Normanna field case.

Last week the Texas Supreme Court declined a second motion for rehearing the historic case, which could pose a threat to small-tract drilling in the state.

The motions for second hearing were filed by attorneys acting for the Railroad Commission and for Bright and Schiff, Dallas independent (OGJ, June 12, p. 92).

There is a possibility that the case will be taken to the U. S. Supreme Court.

But the high court's summer adjournment means there couldn't be any action. The next court session begins in October.

The commission has been holding off action on cases involving field rules in gas pools where there are proration wrangles until the Normanna decision is final.

In the decision, the Texas Supreme Court sent the Normanna issue back to District Court with orders to enjoin the Railroad Commission from enforcing its standard gas-proration formula in this field (OGJ, Mar. 13, p. 100).

Kennedy Puts Swidler in Top FPC Post

• Present chairman, Kuykendall, will step down and serve as member after September 1. Seating of Swidler and Morgan as members last week brings the commission to full strength. But another new member is expected.

JOSEPH C. Swidler will become chairman of the Federal Power Commission September 1.

Jerome Kuykendall, the present chairman, will continue in that position until then and thereafter will simply be a member of the commission until his term expires next June.

This was announced last week when Swidler and Howard Morgan were sworn in as members of the commission.

Thus was settled the issue of whether President Kennedy could name a new chairman before the term of the present chairman expires next year. The law is not entirely clear on that point, and there had been speculation that Kuykendall might make a legal test of the question.

The "compromise" approach avoided a showdown at this time. Meanwhile, there are proposals before Congress which, if passed, would clarify the President's authority before such a problem could arise again.

Under the terms of the announced agreement, Swidler will simply act as a regular commissioner for the next 2 months. Clearly, however, he will also use this period to acquaint himself with the role of chairman so that he will be ready to take over in September.

Kuykendall hinted that he may not continue on the commission until the end of his term. Instead, he said, he might accept private employment before next June. He did not indicate, however, that he expects to do so soon.

The seating last week of Swidler and Morgan brought the commission to its full 5-man strength for the first time in more than a year. The term of Commissioner Arthur Kline expired June 22 but he is continuing on the commission for the time being since no replacement has been made.

Kline has indicated to friends, however, that he will leave at least by the start of the new school year in September, whether he has been replaced by that time or not.

A replacement for him is expected to be announced very soon. If so, the new man could be seated as soon as the Senate acts on his nomination.

The appointment of the fifth man is being awaited with interest because he would become, in effect, a "swing" man. Swidler and Morgan are Democrats while Kuykendall and Commissioner Frederick Steuck are Republicans.

CONGRATULATIONS are exchanged by Joseph C. Swidler, left, and Howard Morgan after they take their seats on the Federal Power Commission.

New member's views . . . Neither Swidler nor Morgan used their swearing-in ceremony last week as an occasion to indicate how they intend to approach their new tasks.

However, in an interview with the Journal earlier in the week, each of the two made it appear likely that this will be the situation:

Each is approaching the assignment with few fixed ideas on natural-gas regulation. And neither expects to seek major policy moves until he has had an opportunity to become thoroughly familiar with the issues. They want to be sure of their ground before committing themselves.

Therefore, the next few months, at least, will be something of a breaking-in period for each.

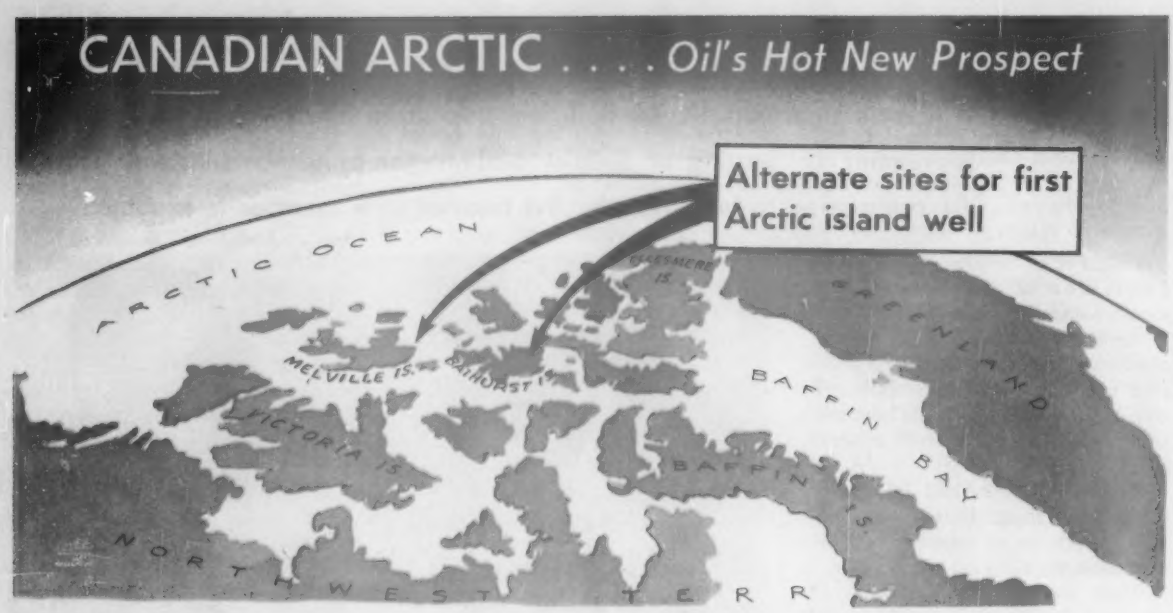
Swidler, a Tennessee lawyer, was for many years an attorney for the Tennessee Valley Authority. He now fills the spot at FPC left vacant when the term of William Connole expired last year.

Morgan, an Oregon rancher, served for 2 years as the utility commissioner of Oregon. Earlier, he had been a member of the Oregon Legislature and was chairman of the Democratic Party of Oregon from 1952 through 1956.

He follows Paul Sweeney, who resigned earlier this year. Sweeney served a short time as an interim appointee after the death of John B. Hussey in March, 1960.

The announcement of the appointments of Swidler and Morgan was made late last January, but the White House did not send the nominations to the Senate until mid-March.

In turn, the Senate committee did not move quickly on the nominations, and it was not until mid-June that the Senate finally confirmed the nominations.



Hopes for "Big Oil" Lure Explorers

• Northern Affairs Department geologists estimate sediments of Arctic mainland and islands could hold 31 billion barrels of oil and 240 trillion cubic feet of gas. First test may start this year.

THE geologically alluring Canadian Arctic islands, one of the world's great untapped sedimentary areas, may submit to the drill before the year is out.

Spurred on by the attractive prospects, and by the government's more liberal regulations, an exploration convoy is scheduled to sail from Quebec in mid-July. Two government ice breakers will lead the convoy.

The group, headed by Dome Petroleum, Ltd., Calgary, hopes to stake a location this fall. Site of the first well in the Canadian Arctic will be determined by the ice conditions when the party arrives.

The top priority is expected to go to Dome's Melville Island acreage. An alternative site is the Bathurst Island acreage of Dominion Explorers, Ltd., another leading Arctic optimist.

Cooperating closely in the pioneering exploration venture is Canada's Department of Northern Affairs and National Resources.

The unorganized Yukon and Northwest Territories, including the Arctic islands, are under federal administration.

Their development is a long-held dream of Canadians, whose population is concentrated along the U. S. border. It is also a political commitment of the present government. And finding major oil reserves offers one of the best hopes for realizing the dream.

Project "Arcticat" . . . Some 17 companies will participate in the first Arctic islands wildcat, estimated to cost $1,000,000.

Sharing the cost in Project Arcticat, of which Dome Petroleum is operator, will be Round Valley Oil Co., Ltd. (Lobitos); Union Oil Co. of California; Canada Southern Petroleum, Ltd.; Tidewater Oil Co.; Clark Oil & Refining Corp.; Dominion Explorers Group, Bankeno Mines, Ltd., Provo Gas Producers, Ltd.; and Dome Petroleum, Ltd.

Members of the group headed by Dominion Explorers, Ltd., Toronto, include Sarcee Petroleums, Ltd.; Canpet Exploration, Ltd.; Mill City Petroleums, Ltd.; Stanwell Oil & Gas, Ltd.; Spooner Mines & Oil, Ltd.; United Canso Oil & Gas, Ltd.; British Matachewan Gold Mines, Ltd.; and Norsyncomaque Mines, Ltd.

Drilling contract has been let to Peter Bawden Drilling, Ltd. The contractor has chartered a 3,000-ton transport to ship the rig, an Oilwell 76 with rated capacity of 11,500 ft. with 4½-in. drill pipe. The ship will sail from Montreal with an annual supply convoy for the islands.

The convoy is scheduled to arrive at Resolute Bay around mid-August and is tentatively due to dock on August 18 at Winter Harbour. From there crawler tractors and trucks will transport drilling equipment 1½ miles to the drill site on shore.

Costs of the drilling program have been based on a 150-day schedule. It is possible that drilling might start this fall and continue through the winter. However, the contractor may rig up but not spud in until favorable daylight conditions arrive, perhaps around the end of February.

Drilling objective . . . The probable location is on the crest of an anticlinal trend adjacent to land that is suitable for an airstrip.

One of the main objectives of the 10,000-ft. test will be the Allen Bay reef of Silurian age. There have been indications that this may be about 3,000 ft. thick. Literally equivalent black-shale rocks of Cape Phillips formation also have attracted interest as promising source beds for oil.

The sands and carbonate of Devonian age and carbonate of Ordovician age also are considered potential reservoirs.

Canada's Possible Oil and Gas Reserves

Area—	Size (sq. miles)	Sediments (cu. miles)	Oil (billions bbl.)	Gas (trillions cu. ft.)
Manitoba and Saskatchewan	176,623	168,072	5.05	33.0
Alberta	236,893	342,715	10.25	67.0
British Columbia	50,688	115,318	3.48	22.6
Yukon	43,000	64,500	1.9	12.3
Northwest Territories	204,794	267,133	8.1	52.5
Arctic Islands	350,000	663,500	21.0	150.0
Total	1,061,998	1,620,238	49.78	337.4

Source: Resources Division, Department of Northern Affairs and National Resources.

Government help . . . The welcome given the project by the Northern Affairs and National Resources officials has been reflected in several ways.

They have provided that companies may participate even in cases where they do not qualify under "Canadianization" requirements.

They are reducing the amount of money which must be spent on exploration if the operators drill deep tests.

They are providing, also, that money spent in the Arctic venture may be credited against the companies' obligations to explore other areas.

The department has indicated willingness to help pay for building airstrips and roads. And, it has offered to aid in arranging for communications and to provide icebreaker assistance if required.

High hopes . . . Awaiting the Arctic expedition is a land whose terrain and climate are as inhospitable and forbidding as its geology is inviting.

Sea lanes can be kept open only 4 or 5 months a year, and then only with ice breakers. The islands themselves have been likened to the face of the moon and the Arabian Desert.

The Department of Northern Affairs and National Resources—No. 1 Arctic booster—would like to foster the notion that Canada's Far North and Arabia have more in common than desolate terrain. On paper, it can make a fair case.

The "expected" reserves of the Arctic mainland and the islands are 31 billion barrels of oil and 210 to 240 trillion cubic feet of natural gas. These combined reserves are seven times the present discovered reserves in all of western Canada.

They were estimated by Northern Affairs geologists using standard formulas based on volume of sediments (see table).

The mainland areas of the Yukon and Northwest Territories were assigned expected reserves of 10 billion barrels of oil and 69 to 90 trillion cubic feet of gas. Arctic island reserves were estimated at 21 billion barrels of oil and 150 trillion cubic feet of gas.

What will actually be found by the drill remains to be seen.

Previous exploration . . . The first well in the Arctic islands will be drilled after only $500,000 has been spent on exploration.

This has been confined to surface and photo geology. There has been no geophysical work.

However, the structures are so big and so plain that seismic work is not considered necessary in the beginning. The islands have been described as a photo-geology play.

Some $40 million has been spent during the past 10 years in exploring the far north mainland areas. During that time 200 wells have been drilled.

Exploratory activity reached a peak last year. Some 16 seismic crews were active, putting in 50 crew months. Drilling of 34 wells—aggregating 112,028 ft.—also was a high point.

But all of the activity in the Canadian Far North has so far developed only one producing oil field of consequence—Norman Wells, in the Northwest Territories, which was found back in 1920.

In a more favorable location closer to market, an operator would be delighted with a Norman Wells discovery. But with Arctic costs, a 100-million-barrel noncommercial find is a definite possibility.

Although the mainland is more accessible, and has drawn most attention thus far, a new enthusiasm seems to be developing for the islands. As one Arctic observer explains it, "The oil fields there should be twice as big and three times as easy to find."

Arctic economics . . . In view of the costs, the odds against laying down Arctic oil at competitive prices would appear to be rather high.

But studies by government economists encourage Northern Affairs officials. If Arctic finds turn out to be of the magnitude that they expect, they believe the oil can compete in Europe and Asia.

The cost of drilling a well in the North is estimated at $500,000 to $1,000,000, at depths of 5,000 to 10,000 ft. Wells on the mainland have been known to cost more than $2,000,000.

However, with increased drilling, and move-in costs spread out over several wells, the average could be reduced to $350,000.

To compete in western Europe, according to Northern Affairs calculations, Arctic island oil would have to sell at $1 per barrel f.o.b. an Arctic port.

Tankers, structurally reinforced to withstand the pounding of ice, would shuttle between an Arctic port and storage on the southern tip of Greenland, which is open all year.

Economic studies were based on 80,000-ton tankers, built at a cost

of $200 per ton, and escorted by 20 to 30 ice breakers.

The shuttle run to Greenland would halt during the 7 or 8-month freezeup, but shipments would continue from storage there.

Although western Europe is seen as the most likely market, the Montreal area of Canada and the U. S. East Coast also are possibilities. The government hopes that Arctic oil discoverers will include some European refiners with an incentive to market the oil.

Oil tankered from the Arctic would not be exempt under the U. S. imports-control program.

If sizable reserves are found on the far north mainland, oil would probably be pipelined to tidewater some 500 miles away at Skagway, Alaska.

The price f.o.b. Skagway would have to be $2 per barrel to compete with Kuwait crude in Japan. It is hoped that Japan will be the outlet for mainland oil. This would give producers a wellhead netback of $1.65 to $1.75.

If Far North supplies could compete with Kuwait sources in Japan, they also could undersell imports on the U. S. West Coast. This would include Alberta oil now going into the Puget Sound, the No. 1 Canadian export market.

New regulations . . . To enable oil to be produced competitively, the government has evolved a set of regulations that are new to the industry.

They are a combination of the North American systems now in force and the concession systems used elsewhere in the world.

The revisions announced this month provide for lower royalties, lower work requirements, and larger lease blocks. They also eliminate the requirements for selling crown reserves to the highest cash-bonus bidder and ease the bar against foreign companies.

Arctic permit holders generally welcomed the changes as further incentive to explore the remote but promising area. Still, there was some dissatisfaction. Operators would like to have even larger lease blocks than the 6 by 3 sections permitted, and a larger percentage of the permit area upon going to production.

But the government believes it has gone about as far as it can in removing industry objections to rules introduced a year ago. The Northern Affairs officials who drew them up believe they are the most progressive to be found anywhere.

Northern Affairs Minister Walter Dinsdale's explanation to the House of Commons reveals his approach:

. . . On eliminating the mandatory bonus bid. "Western Canadian oil is high-cost oil and part of the reason for this is the cash-bonus bid system . . . it encourages overdrilling and closer spacing than is necessary; it requires a complicated prorationing system to insure its continuity; and it encourages inefficient operation because of the diversification of interests in the field."

. . . On alternative methods of disposing of crown reserves, now under consideration.

"They must take into account the necessity of insuring that no more wells are drilled than are necessary."

The Northern Affairs minister himself has authority to determine well spacing after a field has been discovered. And indications are that the minimum in early stages of development will be 640 acres. He further states:

"Recognition will be given to the requirement that companies operating in the North obtain a return on their investment commensurate with the risks involved, and that the crown's share of the gross income must be related to the over-all profitability of the venture."

No rush to Arctic . . . One well doesn't make a boom, and there is nothing like a rush to the Arctic in the offing.

The formidable obstacles of a world oil surplus, high costs, and severe weather conditions have made most majors cool toward the Arctic. These may be too much even for Dinsdale's enlightened regulations.

Still, the Arctic islands are going to get their first well, and the crew that will set sail this month will be the "ice breaker" that Arctic supporters have been wanting.

If this first party or a later one finds major reserves, Dinsdale is counting on the "follow-the-leader" tendencies of oil explorers to do the rest.

Tanker-Strike

COLLECTIVE bargaining alone will not be adequate to settle the national maritime dispute unless one major stumbling block is removed.

This became evident as the strike of maritime workers—which has idled more than 100 American flag tankers totaling 2,250,000 deadweight tons—went through its second week without serious negotiations.

A Taft-Hartley injunction might force seamen to man ships again during the required 80-day cooling-off period while a settlement is pursued. But it will take more than normal negotiations to end the current bitter deadlock.

The reason is that the issues go far beyond the scope of the conference table. They reach into the realm of national and foreign policy. They involve questions as to the future of the U. S. Merchant Marine which will likely end up in the lap of Congress.

Immediate problem . . . Before progress toward a strike settlement can be made, it appears that economic issues which are negotiable must be severed from the broader issues which are not.

Labor and management have been stalled over the issue of bargaining rights on American-owned foreign flag ships. These "flags of necessity"—or in union parlance, the "runaway flag" vessels—flying the ensigns of Panama, Liberia, and Honduras, are the stumbling block barring serious talks.

The hitch is to dispose of the foreign flag question in a way that will satisfy the unions and yet not deliver the foreign crews to their jurisdiction. Even if they were so inclined, the tanker owners say they could not legally grant bargaining rights to the striking unions over foreign crews represented by foreign unions on foreign flag ships.

Complicating factors . . . Clouding the path toward agreement are several unknown quantities and background elements hanging over negotiations including:

. . . The uncertain role of the new administration which opposes existing strike halting law and which is

Outlook: A Real Cure Won't Come Easy

Some effects of maritime strike

114 tankers are idle. These ships total almost 2,250,000 dw. tons. Their capacity is the equivalent of almost 1,000,000 bbl. daily on the Gulf Coast-East Coast run.

4,000 seamen are idle as a result of tanker tieups.

Lost wages total $110,000 per day for seamen alone.

Lost revenue to tanker operators is $440,000 daily.

Indirect costs will exceed direct losses. Included are reduced production revenue, royalties and taxes.

already embarrassingly on record on the major issue in dispute.

... **Questionable legality** of the National Labor Relations Board ruling extending jurisdiction of American labor law to foreign crews of foreign flag American-owned vessels in American-foreign trade.

... **Union rivalry,** whose effects tanker operators apparently regard as a serious obstacle to settlement.

... **Declining state** of the U. S. Merchant Marine together with the trend of American ship owners to register vessels built for foreign commerce under foreign flags to cut labor costs and taxes.

Government role . . . In attempting to mediate the dispute, Secretary of Labor Arthur J. Goldberg finds himself in an embarrassing position on two counts.

The administration opposition to Taft-Hartley back-to-work injunction machinery is well known. President Kennedy voted against it as a congressman in 1947 and Goldberg, as an attorney for the U. S. Steelworkers Union, unsuccessfully challenged its constitutionality before the Supreme Court during the 1959 steel strike.

Also, President Kennedy is already on record as being sympathetic to the unions on the deadlocked issue of foreign flags. As a candidate for President in October of last year, he sent to the National Maritime Union convention a telegram which stated in part:

"I am especially interested and share your concern with your problems and in particular the runaway ship threat to the high standards that you and your union have fought for and established over the years. The runaway ship, like its counterpart the runaway shop, is a hit and run operation which should be stopped."

Whether this was a considered view, or a tactical gambit at the height of an election campaign, remains to be seen. If the President seriously adheres to this view, then ship owners have reason to fear a government-directed settlement of the strike.

President Kennedy's apparent position is in conflict with previous statements of the State and Defense Departments.

In a letter to the U. S. Attorney General on October 27, 1960, Douglas Dillon, then under secretary of state in the Eisenhower administration and now Kennedy's Secretary of the Treasury, wrote as follows:

"Potentially serious international repercussions in the relations between the U. S. and those countries (Panama, Liberia, and Honduras) which could be created by such assertion of jurisdiction by the board (NLRB) over ships flying the flags of those countries are clearly indicated by the diplomatic notes already received by the Department of State from those governments on this subject."

Stating the Defense view at the same time, former Secretary of Defense Thomas S. Gates wrote:

"In my considered judgment, the subjection of these foreign flag vessels to the jurisdiction of the U. S. Labor Management Relations Act

Struck Refineries Operating

ALL SEVEN refineries shut down in mid-June as a result of labor disputes were operating again last week.

The situation was this:

... **Sinclair Oil Corp.'s** four refineries, shut down by a strike of the OCAW, were operating at partial capacity with supervisory personnel manning units. The refineries are at the Marcus Hook, Pa., Houston and Corpus Christi, Tex., and East Chicago, Ind.

Sinclair and OCAW are deadlocked over the union's demand for 1 week's severance pay for each year of service.

At East Chicago, union clerical workers within the OCAW were invited by Sinclair to stay on the job after their contract expired. All of them reported to work.

... **Texaco's** Eagle Point, Pa.; Anacortes, Wash.; and Port Arthur refineries were in operation once more. After Texaco obtained restraining orders limiting picketing, pickets were removed and OCAW refinery workers reported to the job once more.

... **Gulf Oil Corp.** reported curtailed operations at its Ostrica, La., crude terminal because of the tanker tieup.

The terminal serves Louisiana delta and offshore fields and loads tankers for Port Arthur and Philadelphia refineries. Gulf continued its 65,000 bbl. daily cutback in crude purchases.

Gulf's affiliated refinery at Bayamon, Puerto Rico, Caribbean Refining Co., is expected to curtail operations soon. It is without tankers for a crude supply or to ship the products which are piling up in storage.

would very likely have the effect of driving them to registration under the flags of other nations.

"By reason of the high costs of operation of U. S. flag vessels, there is in my judgment no realistic possibility of such ships being transferred to U. S. registry."

Foreign flag ruling . . . The NLRB ruling to which the officials were referring extends U. S. labor law to American-owned foreign flag vessels. It was a bombshell to the shipping industry.

Although the Supreme Court refused to review the decision on appeal—thus allowing it to stand—the ship owners do not consider its legal status settled.

Shipowners liken the foreign flag vessels to plants of subsidary U. S. companies abroad.

"Are the hundreds of plants built and operated abroad by American corporations also then subject to unionization of their employes by American unions?" This is the question asked by the American Committee for Flags of Necessity.

Whatever the final legal determination, the NLRB ruling gave the unions a springboard for bargaining demands on the eve of new contract negotiations.

Union rivalry . . . The ship owners say they are caught in the middle of a "power play" between two rival groups of unions, one headed by Paul Hall's Seafarers International Union and the other headed by Joseph Curran's National Maritime Union.

Bitterness between these two strong personalities and the competition of two unions in the same field has prevented them from presenting a united front.

Hall's triumph, and that of other maritime unions, in winning fatter contracts after Curran had settled for less in negotiations 3 years ago still rankles.

Ship owners fear not only that one company will be used against the other, but that union competition will delay settlement.

Declining merchant marine . . . The deterioration of the U. S. flag fleet has undermined the strength of maritime unions and thus led them to seek all means possible to protect their jobs and expand.

The U. S. Merchant Marine, the mightiest afloat at the end of the Second World War, has rapidly declined through inability to compete in world trade. The American flag fleet hauls only 10% of the cargoes in U. S. ocean commerce.

The Merchant Marine receives a $130,000,000 annual federal subsidy, most of it for labor costs. Tankers are excluded from the subsidy.

The National Labor Policy Committee, representing ship operators, has developed figures revealing the reason for the decline of the American fleet. The daily cost of operating a typical U. S. dry-cargo ship, these figures show, is more than double that for ships registered in England, Norway, or Germany.

Vessel daily expense was reported at $1,910 for U. S. ships, $842 for English ships, $793 for Norwegian, and $848 for German. The disparity between wages was even greater—$1,234 daily for U. S. ships, $353 for English, $311 for Norwegian, and $300 for German.

A way out? . . . Embittered over governmental intervention easing the pressure of their strike, unions last week were not in a conciliatory mood.

Curran, representing the largest striking union (37,000 members), warned that he would renew the strike at the end of the 80-day cooling-off period if an injunction were issued. He promised to hit the ship owners "twice as hard" later.

At the same time Curran appeared to give an indication of his price of a settlement (and duck strike responsibility) short of his

FPC Asks Help on Gas Pricing for

• Committee made up of industry representatives with widely different views is lending hand on problems.

THE Federal Power Commission has called on a 13-member steering committee, representing poles-apart interests, to help search for a method for setting gas prices in South Louisiana.

A prehearing conference at Baton Rouge last week failed to make much headway toward unraveling the monumental tangle of gas-pricing problems. Turning to the committee system appears to be the only way to make any progress at all.

FPC's chief examiner, Edward B. Marsh, set a long-range timetable at the outset by explaining that FPC first will set initial, or interim, rates to be charged under new contracts for gas in the area. This is phase one. Later—in phase two—FPC will establish "just and reasonable" permanent rates.

Many differences . . . The hearing drew some 350 to 400 producers, pipeliners, and distributors. The statements of their chief spokesmen indicated the wide divergence of views represented.

Kent H. Brown, representing the New York Public Service Commission, proposed an interim rate of 17 or 18 cents per thousand cubic feet, including taxes.

To producers such a figure is considered far out of line, even for an interim period. As far back as 1953 contracts were written at 20 cents, plus taxes.

What producers hope for is an interim rate somewhat near the figure to be decided on in phase two.

Oliver Stone, a Shell Oil Co. attorney representing a large number of producers, contended that no interim rate should be set until the companies have presented considerable evidence on field prices, present and future gas demand, and marketing and economic information—but not cost of service data. Stone said such evidence probably would not be ready for presentation until mid-December.

Eastern utility distributors appeared to be pressing for an earlier fixing of rates and an absolute ceiling, subject to periodic review.

As the conference ended, it was decided to hold a meeting of the steering committee in the FPC offices at Washington on July 11 and to resume the prehearing conference in Washington on August 1.

Committee members . . . The steering committee met three times during the 2-day conference last week

basic demand for bargaining rights on foreign flags.

He said tentative agreement had been reached June 20—only 4 days after the strike began—with Texaco and five shipping lines. Terms, as he outlined them, were a 12% pay increase over a 4-year period plus creation by the Secretary of Labor of a special board to consider the foreign flag dispute.

The agreement fell through, Curran said, when it failed to win approval of united-front negotiating committees of the ship owners. Spokesmen for the ship owners said they knew nothing of any such accord.

But Curran's statement appeared to reflect a willingness to settle for a study of the foreign flag question rather than the actual right to organize the ships immediately.

South Louisiana

and conceded at the end that it had accomplished little.

Members of the committee represent large and small producers, pipeline companies, distributing companies, state regulatory agencies, and the FPC. Those named by Marsh:

Stone of Shell Oil, John F. Jones, Pan American Petroleum; Paul Schlicher, Texaco; Jerome Alpher, representing small producers; Evans Attwell, Richardson & Bass; Tom Ryan, Texas Gas Transmission; James O'Malley, Consolidated Edison; J. M. David Mann, United Gas Improvement; Edwin Russell, Brooklyn Union; John W. Glendenning, representing New England distributors; Kent H. Brown, New York Public Service Commission; Harry Mulhern, Public Service of New Jersey; and John C. Mason, FPC general counsel.

Notably absent from the committee is representation from two of the nation's largest gas producers, Humble Oil & Refining Co. and Phillips Petroleum Co.

A Phillips' spokesman, H. K. Hudson, said Phillips would not consider itself bound by any decisions made by the committee. Hudson also said FPC should not fix any initial gas rate without first taking into account supply and demand factors. This was in rebuttal to suggestions from distributors.

Watching WASHINGTON

Clyde La Motte

- **How long will the federal gasoline tax be 4 cents? . . .**

THE HANDWRITING that has been on the wall for some time got transferred to the proper legal documents last week as Congress passed a highway bill which extends the 4-cent federal gasoline tax until 1972.

By this action, Congress made permanent the "temporary" gasoline tax hike that was to have expired last week.

The word permanent is used with some hesitancy because the 4-cent tax may not be permanent at all—it may be hiked by a cent or two more before the highway building program is finished.

The last vestige of a concession to the oil industry disappeared when the Senate-House conferees dropped a Senate provision which would have permitted gasoline dealers a deduction for shrinkage, or evaporation. However, the Treasury Department did agree to make a study of that problem and to make a report to Congress next January.

- **Administration faces its first major labor problem . . .**

THE ADMINISTRATION's handling of the maritime strike is being watched with interest because it will give an indication of the labor policy the Government will follow.

President Kennedy has indicated that he will soon have some proposals to offer Congress for amending the Taft-Hartley law, but it is a good bet that no decision has been made as to the precise nature of these proposals.

Both management and labor, as well as the administration, say they don't like the present procedure under which the White House gets an injunction stopping a strike for an 80-day cooling-off period. But the problem is to come up with an acceptable alternative.

Meanwhile, at Interior, the immediate concern is the impact of a prolonged maritime strike on oil supplies, particularly residual fuel oil.

Lights were burning late at Interior preceding the White House decision to use the 80-day strike-suspension move. The pressure eased thereafter, but Interior still wants to be prepared in case the strike is resumed after the 80 days are over.

Chief concern is not with over-all availability of supplies, but with spot shortages that would crop up as a result of secondary picketing of terminals and trucking operations.

- **Watch for trial balloons on possible tax changes . . .**

NOTE that the administration is running up a pretty good score in getting favorable congressional action on most of its major domestic programs. This sets the stage for turning attention and emphasis elsewhere.

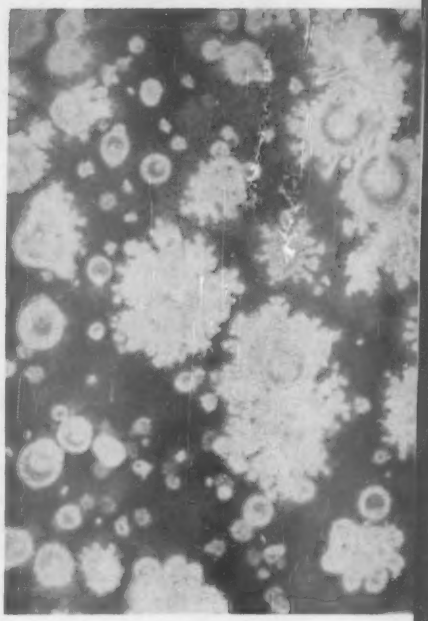
One point sure to get increasing study is the tax structure. The tax suggestions made earlier this year by the President have made little headway and most will probably be dropped quietly. But Kennedy has promised that by next year his tax experts will have a major overhaul plan ready.

The idea of starting from the beginning and rebuilding the tax base has a certain appeal, particularly to theorists. But it isn't realistic. So the Kennedy team will settle for putting patches on the existing program.

Trial balloons will be loosed in the months ahead to give the tax planners some idea as to how the political and economic winds are blowing. Then the next administration move will begin to take definite shape.

Do Jet Fuel Bacteria Cause Slime, Corrosion?

Experts don't agree on the answer to this question. But rising incidence of corrosion and filter fouling in jet fueling systems is causing increasing concern. Big aim of current research: Determine most effective attack.



Why bacteria cause trouble in products

A WIDE variety of "bugs" (bacteria, algae and fungi) thrive on a diet of petroleum products, if they are also able to "breathe" oxygen from water, rust and other extraneous materials mixed with the hydrocarbons. Oil technologists have known this a long time.

The problem with these bugs is not what they eat but the mess they leave. The micro-organisms—both living and dead—and the by-products they create corrode metal tanks and lines and sometimes plug filters.

The bugs like almost all petroleum fractions, but more of them seem to prefer the distillates found in kerosine jet fuels. So the jet age gave a new importance to this old problem.

Today research teams in the petroleum industry, the airline industry, and Government, are working on several promising solutions.

Some jet fuel experts believe bacteria will always be present in jet fuel. But they also believe ways can be found to overcome the problems caused by the bacteria.

This report will bring you up to date on what the researchers are doing and their latest conclusions.

D. H. Stormont
Refining Editor

RESEACHERS and refinery fuel experts are figuratively looking at the jet fuel bacterial problem with a new miscroscope these days.

They are wondering if they, the aviation industry, and some governmental agencies have been indulging in a "bug binge."

Since jets have become the major means of air transport, corrosion of wing tanks and fuel system components and trouble with filter fouling have become more pronounced than with avgas-powered planes. Experiences vary, but the problems are of increasing concern to fuel suppliers and jet plane operators.

The popular opinion for some months has been that micro-organisms—bacteria, fungi, algae, and others—were causing the corrosion and slime.

However, more and more technologists are wondering which is the "egg" and which is the "chicken." Are the bacteria resulting in corrosion or is corrosion creating the bacterial problem?

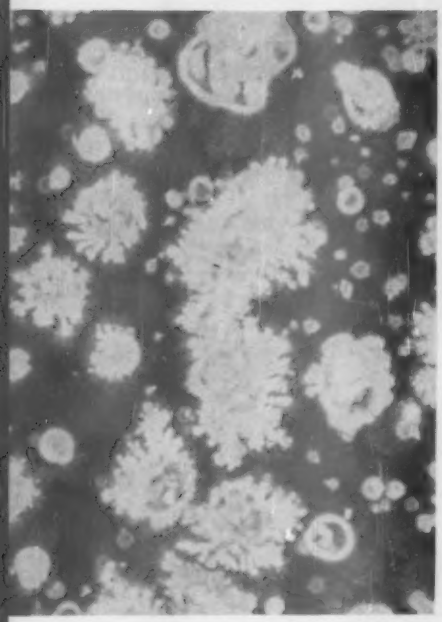
Because of the interrelation between bacterial activity and corrosion, opinion varies as to just how much of the problem can be blamed on microorganisms. Undoubtedly they are contributors. But should the problem be attacked from the bacterial control viewpoint, or should more emphasis be placed on water, rust, and dirt control?

As some jet fuel experts see it, bacteria will always be present in jet fuel. They will not cause any harm, however, so long as water, rust, and other sediments favoring bacterial growth are removed from the fuel. The solution, according to these experts, is to load clean, dry fuel into wing tanks which are protected with coatings impervious to water.

A complicating factor, whether the problem stems solely or only partially from bacterial activity, is the presence of minute quantities of surfactants or soap-like compounds in the jet fuel. These cause water to disperse more finely in the fuel. Plating out on filters and coalescers, they can reduce the efficiency of these devices for removing entrained water. The result can be more water reaching the fuel tank.

The vicious circle . . . Bacteria are part of a vicious circle involving rust and slime. Slime holds the rust and other bacterial byproducts in suspension, particularly at the fuel-water interface where the bacteria thrive. Thus dispersion is increased at the interface, and further multiplication of bacteria is encouraged.

Conventional rust inhibitors won't break this chain. They tend to decrease interfacial tension between the fuel and water, thus increasing



dispersion of the fuel and aggravating the emulsification problem.

Slime-forming bacteria cause trouble in two ways. The slime and other byproducts can plug filters and foul aircraft tank gages. They also are a factor in wing-tank corrosion—acting as a blotter to hold water in contact with the tank skin.

Extent of problem . . . The micro-organisms causing the trouble exist in the soil and in both fresh and salt water. Spores of some are airborne. So clean fuel and wing tanks may be contaminated when a jet is aloft by air sucked into the tanks to balance out consumed fuel.

Once the bugs are in contact with hydrocarbons they can thrive in any oil-water interface. Under proper conditions contamination can extend well into the fuel phase.

Numerous varieties of micro-organisms, including aerobic and anaerobic, have been found to thrive on a hydrocarbon diet. One laboratory reportedly isolated more than 100 such species.

Existence of the hydrocarbon-feeding bacteria has been known for many years but the fuel problem didn't become too important until jet aircraft took over. First trouble occurred a few years ago when the U. S. Navy started using JP-5 fuel for carrier-based planes.

As commercial airlines switched to jets, it became evident that the bacterial problem was more severe with kerosine-type fuels. Several reasons why this is the case are:

Kerosine fuels have a tendency to entrain more water. Since they have a lower gravity and are more viscous, water can't be separated as easily. Kerosine fuels also have a greater tendency to form and maintain stable water-fuel emulsions.

Another reason is the jet's much higher consumption rate. Since much higher volumes of fuel pass through the handling system, filters can plug faster at any given level of contamination.

Still another reason suggested has to do with selectivity of the micro-organisms. Some will attack one type of hydrocarbon but will have no affect on another. By and large, bacteria seem to show a preference for the longer-chain hydrocarbons which comprise kerosine fuels.

Inability to completely drain water from the tanks through sump drains is a serious handicap. If water is allowed to remain in the bottom of the tanks for any length of time, micro-organism growth is almost inevitable.

Role of surfactants . . . In filters and coalescers surfactants further complicate the corrosion and bacterial problem. Their presence results in water becoming more finely dispersed in the fuel, and in reduced ability of filters to separate water.

PROBLEM IN A JUG—Slime like this can be the result when bacteria and petroleum products get together.

Sources of surfactants are not fully known. However, a variety of sources is suspected.

One suspicion is treating methods employed in refineries. Hydrogen-treating is coming into increased use but caustic washing is involved in the bulk of the jet fuels being produced today. This is not the case with avgas.

Another potential source is the wide use of chemical cleaning in refineries and pipelines. If detergents and other cleaning compounds have not been entirely removed, they could be picked up by the jet fuel. Even trace amounts become of consequence when large volumes of fuel are passed through filtering surfaces.

Still another possible source stems from the wide use of inhibitors in petroleum products. Where different products are shipped through a line, contamination can readily occur.

Water control measures . . . Because of the icing problem, water content has always been an important kerosine fuel specification. Commercial airlines generally specify free water must be less than 30 p.p.m., and that particulate matter be less than 2 mg. per gallon. Most fuels delivered today are well within these limits.

Recognition of the severity of the corrosion and slime problem late last year has made both fuel suppliers and the airlines more water conscious. Greater care is now taken to prevent bottom water from accumulating in tankage, in keeping tankage and lines rust-free, and by more frequent inspections.

Insofar as fuel suppliers are concerned, greater effort is being made to see that only clean jet fuels are shipped from the refinery; that lines and tankage are kept free of bottom water and rust. When necessary, storage tanks are sand-blasted and plastic coated.

Although little can be done in existing tanks, some companies are constructing new tankage with bottoms which slope about 1 in. per 10 ft. Bottom water accumulates in one spot and is readily drained. In conventional flat-bottom tanks, local settling results in low spots from which complete drainage is impossible.

At the airports, provisions also

have been tightened. More frequent checks are made for bottom water and fuel quality.

At modern airports, jet fuels are tested and filtered when received into storage. They are also checked and filtered when moved into satellite storage tanks which supply fuel hydrant systems, and then again when loaded into the jet.

Under such a monitoring program, contamination of all types is usually spotted and corrected well up-stream from the wing tanks.

This ideal condition does not always exist. Fuel control must be continued into the jets. If inspection reveals evidence of corrosion, sandblasting, recoating, and other remedial steps are taken as needed. When slime and other evidence of bacterial activity are found in the tanks and fuel systems, they are cleaned with detergent, flushed with cold water, and thoroughly dried.

Role of research . . . Continued effort to solve the rust and water problem will result in the corrosion and bacterial problems being brought under control, many jet fuel experts believe. But extensive research, sponsored by oil companies, industry committees, and government agencies is continuing.

The nature of the research varies widely. Some is directed toward additives which will control bacteria. Other is pointed at the fuel composition itself; toward hydrocarbons less appetizing to bacteria. Oil industry research generally is directed at conditions and environment most conducive to bacterial growth.

. . . Use of boron compounds as an additive is undergoing study in several oil company labs. These include water-soluble compounds, such as borax, as well as hydrocarbon-soluble compounds such as glycol borates.

Interest in boron compounds stems from the bactericidal effect that boron motor fuel additives give gasolines. Several years' experience with these fuels resulted in tankage free of slimes and other microbiological by-products.

Regardless of the type additive used, fuel experts of some oil companies say this approach treats the effect and not the cause. They don't believe that economical, suitable bactericides and fungicides will be found. In view of the length of time required for the aviation industry to approve changes in fuels, sometimes 2 years or more, additives offer no immediate solution.

Another objection is the ability of micro-organisms to adapt themselves to their surroundings. A bactericide may be effective for a while, but all too often strains develop which will feed on the material that was toxic to their forebearers.

Another roadblock is the possible harmful effect an additive may have on fuel system components and engine parts. Finally, many of the proposed additives increase the tendency of fuel to contain dispersed water and dirt which can cause corrosion without the organisms.

. . . Fuel composition is the object of a 2-year program recently started at Oklahoma State University. Goal of the study—sponsored by the office of Naval Research—is to determine how some hydrocarbons can halt the growth of certain bacteria. This approach is not thought to be feasible by some knowledgeable researchers.

Additional research is under way in the labs of several major oil companies, and research organizations. After initial meetings early this year between oil industry and air transport representatives, studies also were started by the Coordinating Research Council to determine the extent of the bacterial problem.

Murphy Seeks Larger Market

- Ingram merger would give growing Arkansas firm a Baton Rouge refinery, 212 gasoline stations in Southeast U. S.

MURPHY CORP. has moved to strengthen its marketing position in the southeastern U. S.

Latest step is the proposed merger of Ingram Oil & Refining Co. into Murphy.

The $16½-million deal includes Ingram's New Orleans refinery, which has a throughput capacity of 20,000 bbl. a day and is well located in relation to Murphy's active role in offshore-Louisiana production and exploration.

Ingram also operates seven product terminals along inland waterways. The firm markets through 212 outlets in Louisiana, Tennessee, Florida, Mississippi, Alabama, Kentucky, and Georgia.

It will involve the exchange of 440,000 shares of Murphy common stock, recently quoted at 26¾ a share, and $5 million of Murphy preferred stock for all outstanding common stock and preferred stock of Ingram.

Growing fast . . . The Ingram proposal comes less than a year after Murphy merged with Spur Oil, one of the largest gasoline distributing companies in the U. S., and purchased National Petroleum Corp., small marketing company in St. Petersburg, Fla.

Murphy distributes its refined products through 557 stations in 24 states, District of Columbia, and Canada. It has crude and natural gas production in the U. S., Canada, and Venezuela, and operates a 15,000-bbl.-daily refinery at Superior, Wis.

Murphy's sales of finished petroleum products have been running ahead of its crude oil and gas liquids production.

Pollution Order Issued

A SWEEPING pollution order calling for elimination of all unlined salt-water disposal pits over a six-county area of the Texas Panhandle has been issued by the Texas Railroad Commission.

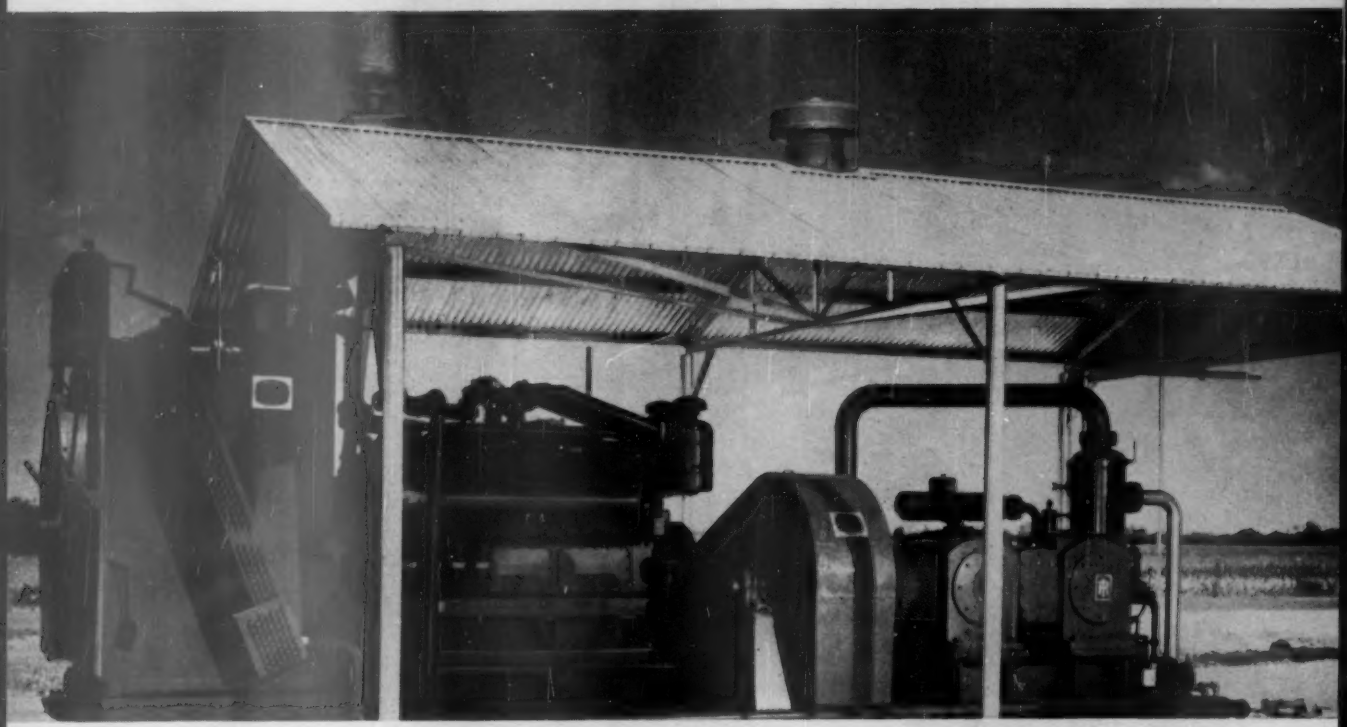
The commission advised Panhandle operators they have until July 1, 1962 to complete programs to dispose of their salt water in some other way.

The order went out to operators in Hansford, Hartley, Hutchinson, Moore, Ochiltree, and Sherman counties. It suggested immediate action.

Commission action followed a hearing held on a petition by the North Plains Water District, which complained that any type of unlined pit would allow seepage and contamination of fresh-water sources.

engine power
BY CATERPILLAR

Gathering station for five natural gas wells on J. M. Dellinger's Aqua Duce, Texas, ranch is powered by Cat G397 Natural Gas Engine with Ingersoll-Rand two-stage compressor. Engine operates 24 hours a day, seven days a week, pumping 2,700,000 cu. ft. a day.



We asked J. M. Dellinger why he specified a Cat G397 for his Aqua Duce, Texas, gathering station

"It not only gives maximum production at the lowest operating cost, but when the time comes to trade or dispose of Caterpillar Engines, they have a much higher trade-in or market value than any other machinery of their type. The availability of parts and service through a fine dealer organization is a great factor in making Caterpillar Engines profitable to own and to operate. With a large natural gas supply on my ranch, it became necessary to install a gas compressor. When I learned that Caterpillar Natural Gas Engines were available, I insisted that the Model G397 be installed with an Ingersoll-Rand Compressor. This was even though I had tentatively ordered another engine brand."

Businessmen, like Mr. Dellinger, buy on business logic. They don't change their minds on whim—but when a better choice comes along, they recognize it and act. That's just what Mr. Dellinger did.

Cat Natural Gas Engines yield high continuous horsepower at extremely low cost. Maintenance costs are low. Cat Natural Gas Engines need no derating for continuous operation. Two compression ratios are available for use with a wide variety of gaseous fuels. They are available with 6, 8 or 12 cylinders, naturally aspirated or turbocharged and aftercooled, with continuous output ratings to 725 HP.

For complete information on Cat Natural Gas Engines see your Caterpillar Dealer or your machinery supplier early in your planning. He'll be able to save you money on initial investment and on operating costs.

CATERPILLAR

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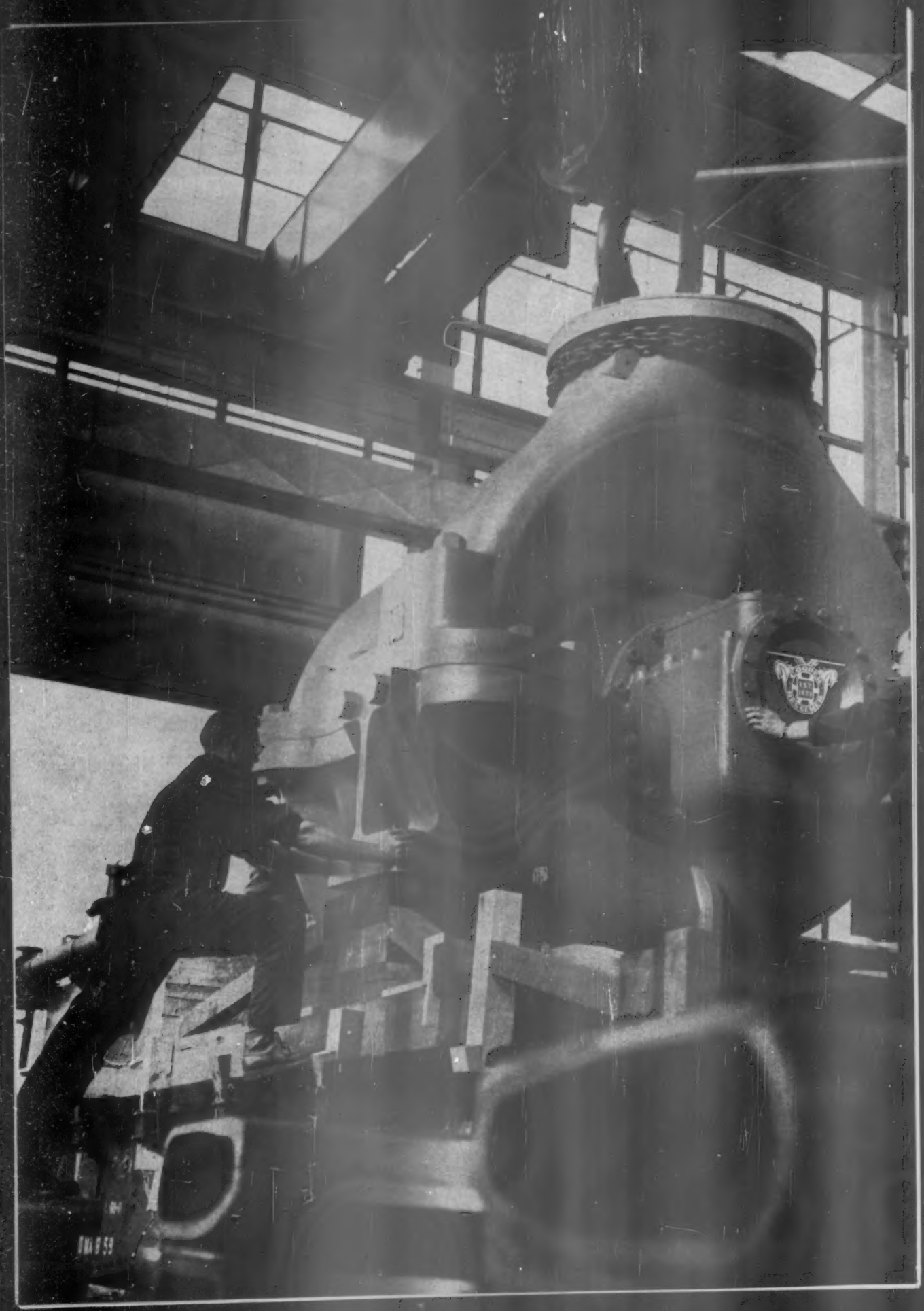
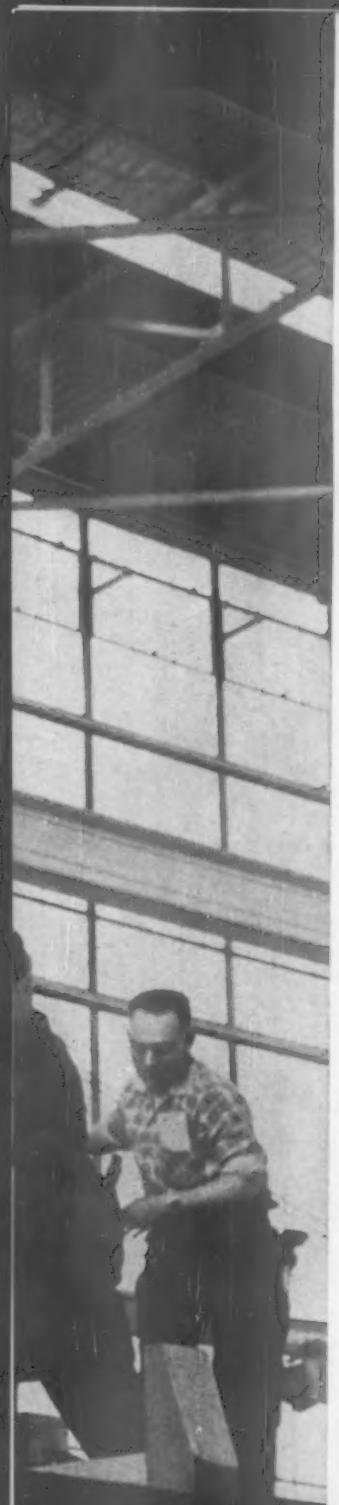
Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A.





Another Cooper-Bessemer centrifugal goes to work

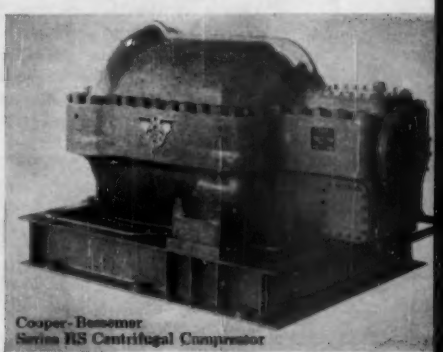
Here's proof of compressor economy

When your plans call for centrifugal compressors, it will pay you to be guided by the experience of others. Take a tip from the *repeat order* record of Cooper-Bessemer centrifugals as a sure sign of *cost-saving performance.*

The Cooper-Bessemer centrifugal shown here is being shipped to a chemical manufacturer for big volume compression. They *know* how reliable C-B centrifugals really are. Another unit has been operating there 'round-the-clock for two years, as part of a process, where constant availability is a *must.*

Repeat orders for Cooper-Bessemer centrifugal compressors have come time and again from many progressive companies.

Many features account for the stamina and dependability of Cooper-Bessemer centrifugal compressors—such as their rugged all-welded impellers, and unique shaft sealing. Find out how they can pay off for you. Call our nearest office or write



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JET-POWERED GAS TURBINES

Continuous-core drilling rig

is new oil exploration tool

Dependable International power helps prove continuous-core concept in year of field testing

Here's a follow-up report on continuous-core drilling conducted by Strato Drill, Inc., Houston, Texas. A year of drilling in a wide variety of formations, at depths to 3,000 feet, has shown the new method to be completely successful as an aid to the geologist in obtaining more detailed, more reliable subsurface information. The prototype drill has proved that savings can be expected because of reduced hole size and pump size; also less hydraulic pressure, pump volume and pump horsepower are required.

Economy of operation and reliability of equipment were of prime importance in this experiment, and it is significant that the driller chose International power. Two heavy-duty International V-8's on Strato's No. 1 performed economically and dependably throughout the extensive testing period. Your power requirements, too, can be handled with a call to your nearby International Engine Distributor or Dealer. He'll be happy to give you full information on any of the 35 models—16.8 to 385 max. hp—stripped engines to complete power units. Call him soon!

Strato Drill's Rig No. 1 on location in Glasscock County, Texas. Loop over mast is core-return tube through which cores are circulated to surface as soon as they are drilled. Reverse circulation is the key to the continuous-core method. Fluid is pumped down annulus between drill pipe and core tube; it goes out into the open hole just above the bit, then rises to surface through core tube. Core segment comes up in ascending fluid as a free body, with little mechanical damage. Pipes are rotated by power swivel on mast. International engines pump from two mud tanks. One mud is especially formulated to be used for drilling fluid. The other, heavier mud, formulated to protect hole walls, is introduced into the hole annulus, and is also held in reserve for killing a gas blow or controlling high pressures. Core recovery has been 100% in most cases.

INTERNATIONAL® ENGINES

International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill.

A COMPLETE POWER PACKAGE

Oil Firms Get 4% Reduction

Tube-Goods Price Cut is First Since War

OIL COMPANIES are enjoying their first price cut in tubular goods in 20 years.

New prices for casing and tubing, first announced in late June, have now become general.

They are the first price change since 1958, when prices went up for the sixteenth time since the end of the war.

Whether the new prices will stick was still a question last week.

Actually, the price move started out as a method of giving better service to oil companies rather than a cut in the price of tubular goods.

The kickoff was a 4% discount to independent jobbers, awarded as compensation for their added burdens in a new buying pattern.

Here's how the pattern works:

A company places an order 60 days in advance with a steel mill. Goods are delivered on consignment to a yard other than the customer's, and after the 60-day notice expires the company has 90 days in which to move the goods.

The jobber holds the goods in inventory and absorbs all handling costs. He doesn't get paid until the pipe goes to the well site. If the goods aren't moved within 90 days, the oil company is billed and starts paying storage on the goods.

Mills agreed to give jobbers an extra 4% on mill shipments to their storage points, since the jobbers would have to handle the pipe, pay taxes on the inventory, and absorb normal storage fees.

Then, before the 4% discount feature was well established, one supplier elected to pass the discount on to the customer and other suppliers followed.

This amounted to a price cut for oil companies.

It is estimated that the saving to companies ranges between $8 and $11 per ton. Last year's sales amounted to more than a million tons.

In-transit stocks . . . When the 4% discount was inaugurated, it applied only to mill shipments.

Some thought in-transit stocks—those carried by a mill at a river point to expedite jobbing and delivery—would be wiped out, since suppliers could save money by buying direct from the mills.

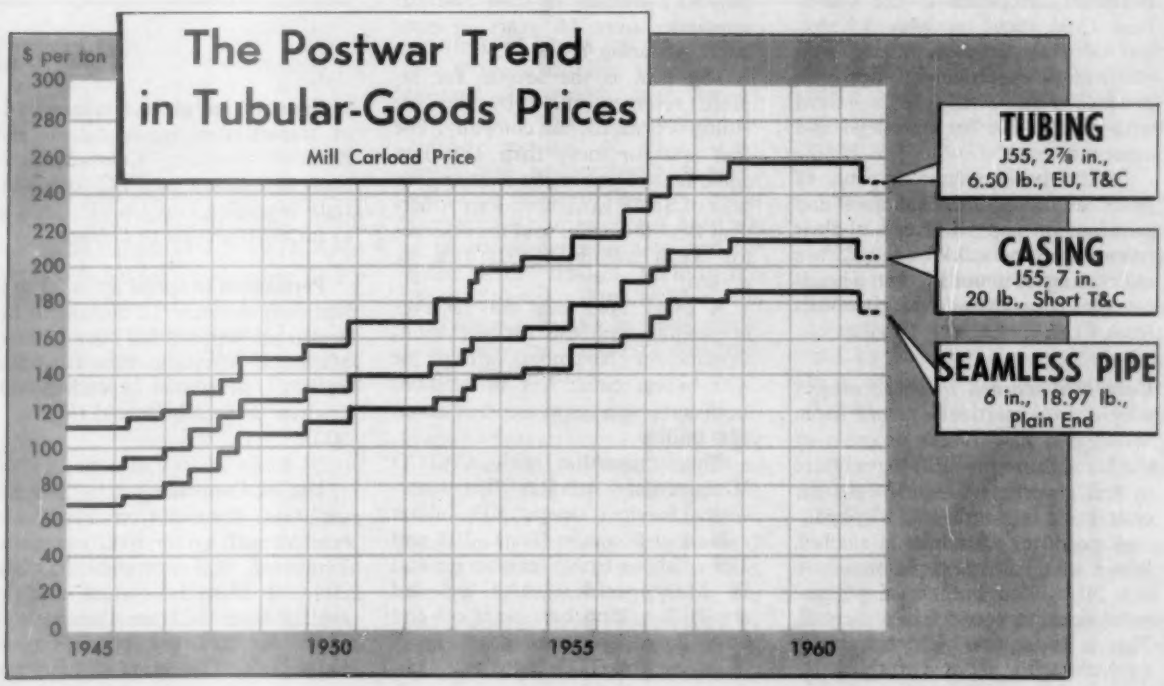
But within a few days the mills announced they would apply the 4% cut in transit stocks, too.

This took away the incentive for an oil company to give the mill 60 days' notice of its needs, since it can buy nearly all of its tubular goods from nearby points at the same price.

Distributors and majors contacted last week termed the whole situation "a fluid deal," and one that could change at any time.

"At first the jobbers were elated over getting the 4%," said one industry spokesman. "Now they're dejected over losing it. The thing canceled itself out."

Oil companies, on the other hand, had plenty of reason to be pleased—since what began as a maneuver for better service wound up as a cut in their biggest single cost in drilling and production.



Government Pushes Corn "Petrochemicals"

• Enjay president says federal backing for coal-gas study, alcohol-from-corn project constitutes threat to natural gas in petrochem raw-materials field.

A PETROCHEMICAL industry leader warns oil men that the federal Government soon may subsidize noneconomic petrochemical raw materials such as coal and corn to make them competitive with natural gas.

President J. E. Wood III of Enjay Chemical Co., a Humble subsidiary, voiced his concern at the national convention of the American Association of Petroleum Landmen in Houston.

Wood cited half-a-dozen cases where private industry has abandoned use of nonpetroleum products and gone to natural gas as a feed stock of chemical processing. But the U. S. Government currently is giving serious consideration to two projects which, if carried out, would constitute a dangerous threat to the industry, he said.

The projects:

... Research on gasification of coal by the Interior Department.

... Use of cheap government-owned corn for making industrial alcohol.

Wood said John M. Kelly, assistant Interior Secretary for mineral resources, proposed at the Cleveland Coal show on May 15 that the Government move ahead with gasification experiments. Aim is to produce a gas which can be mixed with natural gas for industrial and consumer use.

"With the economic impetus of practically zero material cost and government-paid, all-free-and-clear research behind it," Wood said, "we may see again in our lifetime a headline that reads 'Now: Petrochemicals from Coal.' "

Corn deal scorned . . . The project which drew particular scorn from Wood is a new 1-year program of the U. S. Department of Agriculture to sell government-owned corn for conversion into industrial alcohol.

A producer of industrial alcohol, Wood said, has asked permission to buy 30 million bushels of government corn to convert into alcohol. This is enough to yield a quantity equivalent to about two-thirds of the entire U. S. market at present.

The U.S.D.A. has suggested it will actually use about 15 million bushels of corn in its 1-year program.

Wood said synthetic alcohol producers have invested some $200 million in research and equipment "on the proven premise that alcohol cannot be made economically from corn without government subsidy."

Corn might be considered economic as a raw material for industrial alcohol if priced at about 60 cents per bushel or less, but the Government supported the price of corn last year at $1.06 and this year at $1.20. The manufacturer will get the corn at about 60 cents delivered. The netback to the Government, after freight and handling, will be about 20 to 30 cents per bushel.

Oil, gas preferred . . . Wood cited a number of cases where industry has found petroleum and natural gas to be superior to other raw materials, such as the replacement of furfural from oat hulls by butadiene from petroleum in making nylon.

Philadelphia & Reading Corp. only recently shelved plans for using strip-mined anthracite for chemical synthesis and has, instead, joined other companies to produce petroleum - derived chemicals at Beaumont.

TGT Wraps Up Second Reserves Purchase

TENNESSEE Gas Transmission Co. has completed a long-negotiated deal for the purchase of more than ½ trillion cubic feet of in-place reserves off Louisiana from the CATCO group.

Sale price for the reserves is approximately $97 million. TGT will pay $2.2 million in cash and the remainder over 16 years in non-interest-bearing notes.

The deal is the second for in-place reserves made by the big Houston transmission company. The first was for more than 1 trillion cubic feet of gas in the Bastian Bay area of South Louisiana. Pan American Petroleum Co. sold the reserves for $150 million (OGJ, Feb. 6, p. 86).

A third TGT deal for reserves is pending with the MCN (Mobil-Continental - Newmont) group for 470 billion cubic feet of offshore Louisiana reserves at a cost of about $60 million.

The transaction with CATCO (Continental - Atlantic - Tidewater-Cities Service) covers 533 billion cubic feet of gas in Blocks 198 and 199 offshore from Terrebonne and St. Mary parishes. Also included are 16.2 million barrels of oil and other liquid hydrocarbons.

Acting for TGT were two subsidiaries, Tennessee Gas Supply Co., which bought the gas reserves, and Tenneco Oil Co., which bought the oil reserves.

TGT plans to file an application with the Federal Power Commission to construct facilities to connect the gas reserves with the company's

PIPELINE

Construction of 16.7 miles of 16-in. transmission line in Adams and Boulder counties, Colorado, has been authorized by FPC for Colorado-Wyoming Gas Co. Purpose is to improve service to Denver.

Permission to spend up to $3 million over the next 12 months to increase gas supplies has been granted Michigan Wisconsin Pipe Line Co. by FPC. Maximum expenditure on any one project is limited to $500,000.

Use of Canadian gas by Tennessee Gas Transmission has again been denied by an FPC examiner. Tennessee had proposed to take 204,000 M.c.f.d. — when and as available—from Trans-Canada Pipe Lines for delivery near Niagara Falls, N. Y. The examiner held that

main transmission lines which cross southern Louisiana and extend east and north.

Purchase of the new gas will increase TGT's total reserves of more than 17 trillion cubic feet by more than 3%. It also reaffirms the company's faith in the new method of acquiring in-place reserves, through which it gains flexibility in gas dispatching, avoids price inflation in future years.

Pennsy Railroad Planning Products Line

THE PENNSYLVANIA Railroad has proposed an 80-mile products pipe line from Baltimore to serve airports and military bases in the Washington, D. C., area.

Customers would be Friendship International Airport between Baltimore and Washington, Washington National Airport, Andrews Air Force Base, and Dulles International Airport, Chantilly, Va.

In addition to aviation fuels, the proposed common carrier would transport automotive gasoline and fuel oil to marketing terminals along the route.

The line would originate at a terminal in the Curtis Bay area of Baltimore, where shipper storage would be constructed. Products would be tankered from Gulf Coast refineries to the terminal.

A Pennsy affiliate, Potomac Public Service Co., has opened offices in Arlington, Va., and has retained Pipe Line Technologists. Inc., Houston, and Sverdrum & Parcel, St. Louis, to develop the project. The railroad right of way would be used for part of the route.

Pennsy has long cherished a wish to bolster its revenue in the East by broadening transport service to include pipelining.

It would join Southern Pacific, Missouri-Kansas-Texas, and Great Northern in entering the business which has won much petroleum traffic from railroads in recent years.

Union Oil Paying Higher Interest On New Debentures

UNION OIL CO.'s move to get out from under the threat of control by Gulf Oil Corp. will be a costly deal for the California company.

Union is offering $120-million worth of debentures to buy the same amount of convertible debentures held by Gulf. The new offering is split down the middle with half being regular debentures and the other half convertible debentures.

The interest rate on the new debentures is higher than the present Gulf debentures, which have a 3¼% rate. The regular debentures offered carry a 4⅞% rate and the convertible debentures a 4¼% rate. This will increase Union's interest payment on the debentures about $1.5 million a year.

The new convertible debentures are due in 30 years. The conversion rate is $65 a share before June 1, 1966, then goes up $5 a share on a 5-year schedule to a top of $90 after June 1, 1986.

Union has reserved 923,076 shares for the conversion. This would be just over 9% of Union's outstanding common based on the 8,709,807 shares outstanding April 30. The Gulf debentures would have equalled 25% of Union's common had the company converted.

The antitrust case against Phillips Petroleum Co.'s acquisition of 15% of Union's stock is still on file in Los Angeles, but a trial is not expected until fall or winter. The Government claims Phillips is seeking to control Union and has obtained an injunction which prevents Phillips from voting its stock or acquiring any more stock.

BRIEFS...

Tennessee had adequate supplies from present sources.

Interstate natural gas pipelines took in $311,494,018 during April, an increase of 11.4% over April 1960. Sales for resale were 703.8 billion cubic feet, up 11.6%, and sales to consumers were 132.6 billion cubic feet, off 3.2%. Combined net income of $26,634,685 in April was off 1.6% from a year ago.

The 68-mile system which Teton Pipe Line Corp. built to connect the Dead Horse Creek-Barber Creek area to Service Pipe Line's Sussex, Wyo., station went into operation in June. The system is made up of a 6-in. main line and 3 and 4-in. gathering lines. The fields are located in the Powder River basin.

Effect of stress on notched or deeply scratched line pipe will be checked this month near Athens, Ohio. Tests will be carried out on 200-yd. sections of 30-in. pipe, which will be purposely damaged and then made to fracture under pressure. Recordings will be made of pressures, temperatures, and the speed of the fracture as it travels along the pipe. Battelle Memorial Institute will handle the tests, under auspices of the Line Pipe Research Committee of AGA.

Tariffs for gathering oil in southeastern Saskatchewan fields have been reduced by Producers Pipelines, Ltd., and Westspur Pipe Line Co. effective July 1. Per barrel reductions by fields are Midale A, 2 cents; Midale C, 1 cent; Cateville, 4 cents; Alameda, 1 cent; Alida, Arlington, and South Ingoldsby, ½ cent; Parkman, 4½ cents; Kenosee, 7½ cents. Rates on joint tariffs from Midale and Steelman terminals to Superior, Wis., and St. Paul, Minn., were reduced accordingly. A general tariff reduction was also made in February.

Work has begun on a 60-mile gas line which Saratoga Processing, Ltd., will operate between Savanna Creek and Coleman, Alta. The line, made up of 45 miles of 16-in. and 15 miles of 4-in. and 6-in., is being laid by Banister Construction Co. It is scheduled for completion by August 25.

The 208-mile gathering system which Petrogas Processing Co., Ltd., is installing in the vicinity of Balzac, Alta., is scheduled for completion October 15. The line is being laid by Banister Construction Co., Ltd. Banister also has the coating contract for 1,098,240 ft. of 2-in. to 8-in. line.

Better Perforating Achieved With New Charge

A NEW METHOD for getting a sustained detonation that will produce more effective perforations in the formation has been developed for the oil industry.

Schlumberger Well Surveying Corp. has introduced the new shaped charge known as "Crack Jet." It is particularly useful in the harder formations.

The secret of the charge is the "reactive liner."

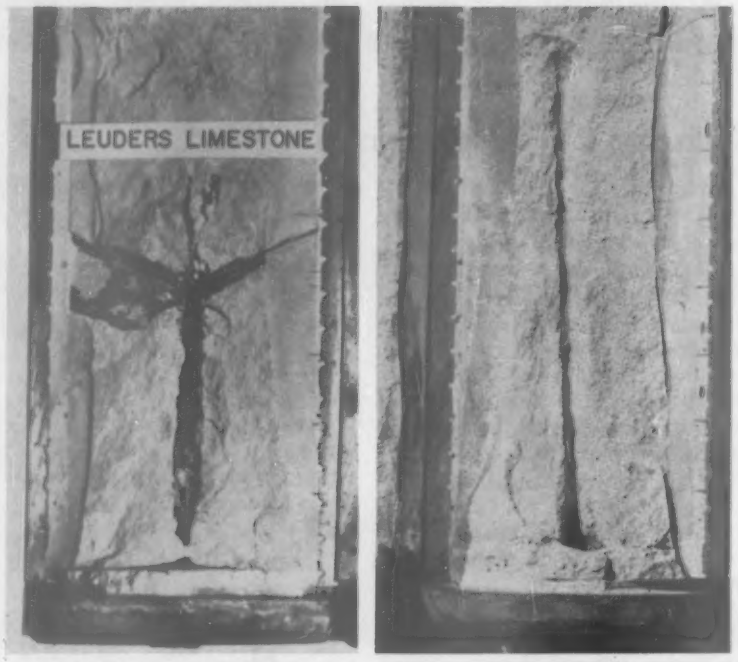
The liner is made of an element which combines with the gases of detonation and with the formation material itself to create a sustained detonation within the perforated hole. Schlumberger did not say what element is used to make the liner.

This is how the company explains the difference between the new and conventional perforating methods:

With conventional copper and zinc liners, the energy is expended chiefly in perforating the target. With the reactive liner, the particles of the liner provide an additional source of energy.

The heat energy that is liberated — or the explosion — occurs both during and after the jet penetration, bringing additional force against the walls of the perforation.

In laboratory tests, Schlumberger found little difference in results with highly permeable cores. But there was a sharp difference — greater fracturing within the formation — with less permeable cores, the research men said.



NEW perforating technique, using Schlumberger's "Crack Jet," left, produces much greater cracking at end of penetration than firm's "No Plug" charge.

The company says the new charge also produces a much cleaner perforation and is beneficial in wells to be either fractured or acidized. Operators are able to get better or comparable results by using two shots per foot, instead of the normal four shots.

The "Crack Jet" charge is now available and Schlumberger says it costs no more than its conventional "No Plug" charge.

Processing Briefs . . .

Engineering and construction contract for a polybutadiene plant at Sarnia, Ont., has been awarded to Catalytic Construction of Canada, Ltd., by Polymer Corp. Construction will start this summer with completion scheduled before the end of 1962. Estimated output is 20,000 tons per year.

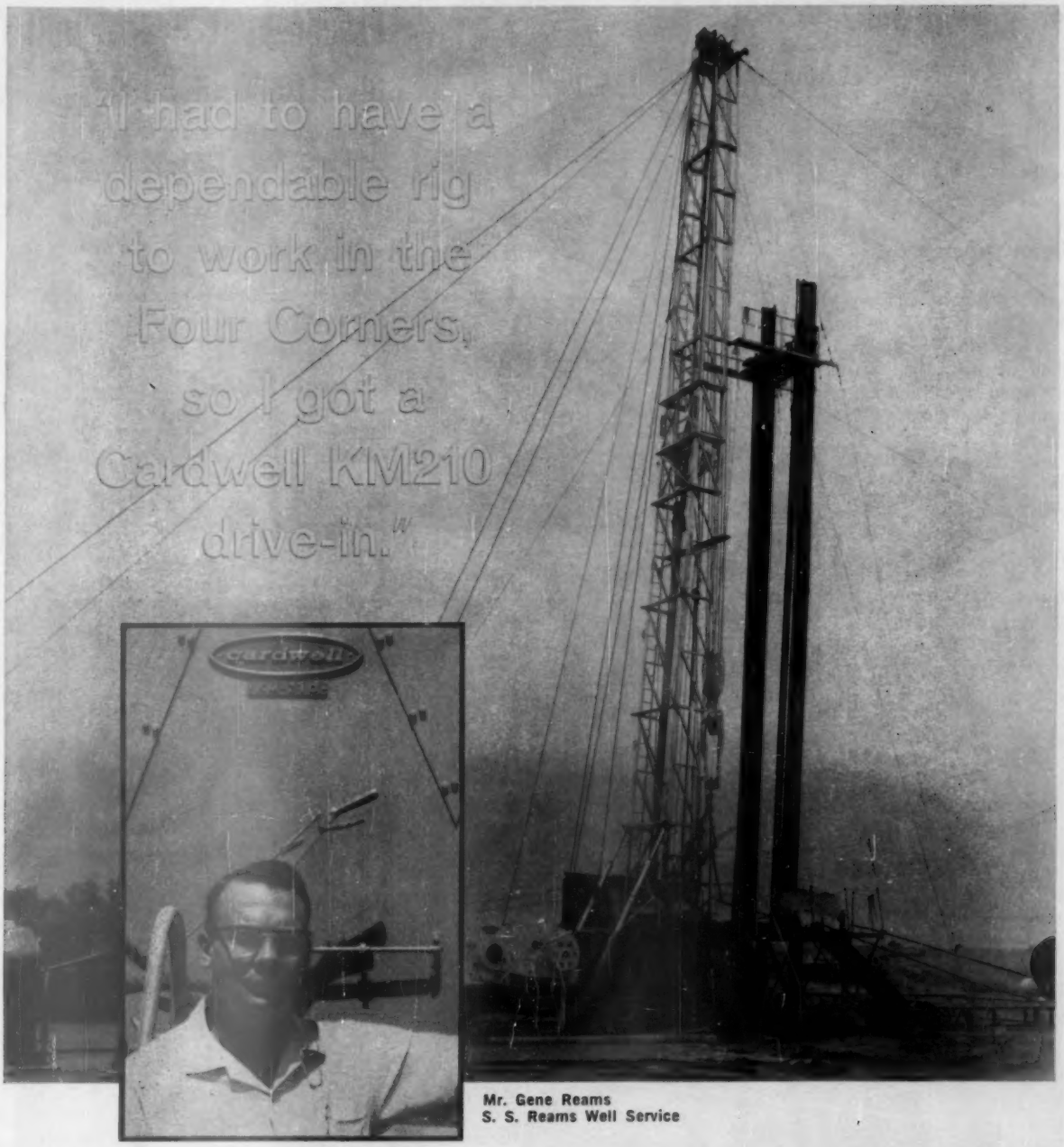
Permission has been asked by Steelman Gas, Calgary, to build a $1.6-million 70,000-M.c.f.d. gasoline plant. It asked Alberta Oil & Gas Conservation Board to approve plants to extract ethane and higher fractions from transmission lines which run from Pembina, Lobstick, Bonnie Glen, Wizard Lake, and Glen Park fields to Edmonton. The pipelines belong to North Western Utilities.

A thermal cracking unit with a capacity of 56,000 bbl. daily has been shut down permanently at American Oil Co.'s Texas City refinery. The unit was shut down for two reasons: To prepare for start-up of the new 150,000-bbl. daily crude unit this fall (OGJ, April 17, p. 116), and current oversupply of gasoline.

Petroleum - derived benzene production this year is expected to reach 450 million gallons. Out of this total, Shell Oil Co. says it will produce over 80 million gallons which will make it the largest benzene producer in the world. The firm enlarged its benzene facilities earlier this year at Wilmington, Calif., Houston, and Wood River, Ill. Shell produced the first commercial petroleum benzene in 1947.

A gasoline plant with capacity of 30,000 M.c.f.d. will be built by Humble and Standard-Western at Gaviota, Calif. The plant will serve gas - producing properties jointly owned by the two firms. A similar plant at Carpinteria is also being considered by the firms.

A Houdriforming unit with a nominal design capacity of 6,000 bbl. per stream day is now on stream at Tenneco Oil Co.'s Chalmette, La., refinery. The new unit was designed for aromatics production.



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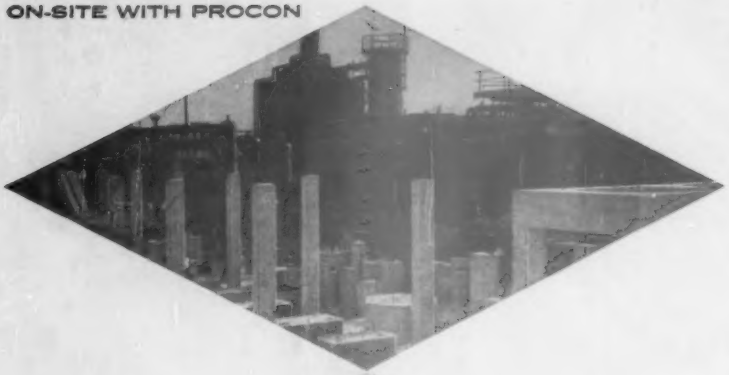

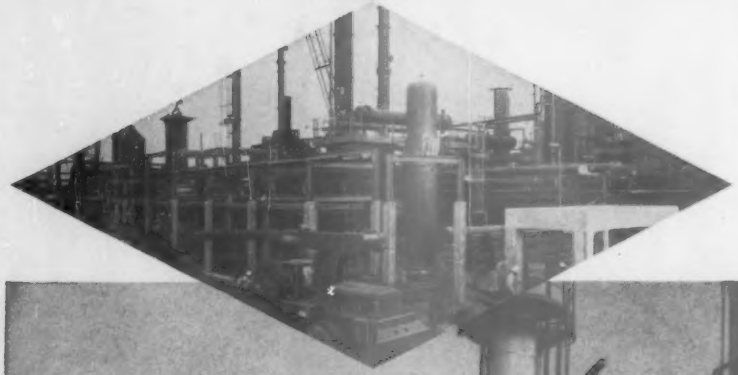

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Argentina Opens New Area to Oil Exploration

• After 2-year delay, YPF signs long-term contracts with Continental, Ohio for exploration, development program in 15-million-acre wildcat territory.

CONTINENTAL Oil Co. and Ohio Oil Co. have signed 40-year contracts for a major exploration program in northern Argentina.

They are the first contracts approved by YPF, the government oil agency, for Argentina proper since 1958. Tennessee Gas Transmission Co. won similar rights in 1959 for work in Tierra del Fuego.

The separate but identical agreements, signed after 2 years of delay, give Continental and Ohio adjacent blocks of 7.4 million acres each. Exploration will be handled as a joint venture.

Work is to start within 180 days after the contacts are given final approval by the Argentine Government.

An LPG line and a natural-gas line built by Fish International cut through the huge blocks of wildcat acreage (map).

The LPG line runs to San Lorenzo, where Continental and four other U. S. firms are building a $70-million petrochemical complex. The gas line extends to Buenos Aires (OGJ. Jan. 23, 1961, p. 63).

The contracts allow 10 years for exploration and 30 years for development.

Other terms:

... YPF will buy all the crude it needs for $11.75 per cubic meter (about $1.87 per barrel) at the wellhead and will pay another $2.25 per cubic meter (36 cents a barrel) for its delivery to San Lorenzo. Payment will be 60% in U. S. dollars and the rest in Argentine pesos.

... Crude not wanted by YPF may be exported at any price the companies can get. They will pay the government an 18% royalty based on the wellhead price.

The 18% will be taken into consideration in computing a 50-50 split on export profits between Argentina and the company. Third-party crude sales in Argentina will not be allowed.

... For gas, YPF will tie its payments to the price of Bunker C fuel oil. It amounts to 26.7 cents per M.c.f. at present prices. Gas production may be sold to third parties in Argentina.

... Acreage reductions will leave the companies with 25% of their initial holdings after only 10 years.

They must give up 50% after 6 years and another 25% of the original grant at the end of the 10-year exploration period. They may relinquish additional acreage at any time.

... The companies must spend $16 million each on exploration and production during the first 10 years unless they choose to voluntarily give up more of their holdings than the agreement requires.

The schedule for each company: $2.5 million the first three years; $5.5 million the second three; and $8 million the next four. Investment requirements will be cut if the companies voluntarily give up any acreage. But the minimum is $2.5 million for each of the three periods.

Should YPF have cause to void the contracts, the companies will have to yield their fixed installations without compensation and could be penalized from $500,000 to $2 million.

The Conoco-Ohio deal is in line with Argentina's efforts to enlist private-company help in expanding production. The nation is running ahead of schedule on its oil policy, which has a 1964 target date for self-sufficiency in petroleum.

Russian Oil Not Wanted in UK Market

RUSSIA has run into a brick wall in its efforts to sell oil to England, the export market it wants to break into most of all.

Reginald Maudling, president of the British Board of Trade, said at the British Trade Fair in Moscow there is no room for Soviet oil in UK markets.

He said the British stand was taken for commercial rather than political reasons.

"We have a surplus of oil. Why should we buy something we don't want?" Maudling said.

He referred to supplies of British-produced oil in sterling areas, especially in the Middle East, that make British companies net sellers, rather than buyers of oil.

About $4 million worth of Russian products a year are now being imported into the UK. But these are mostly lubricating oils.

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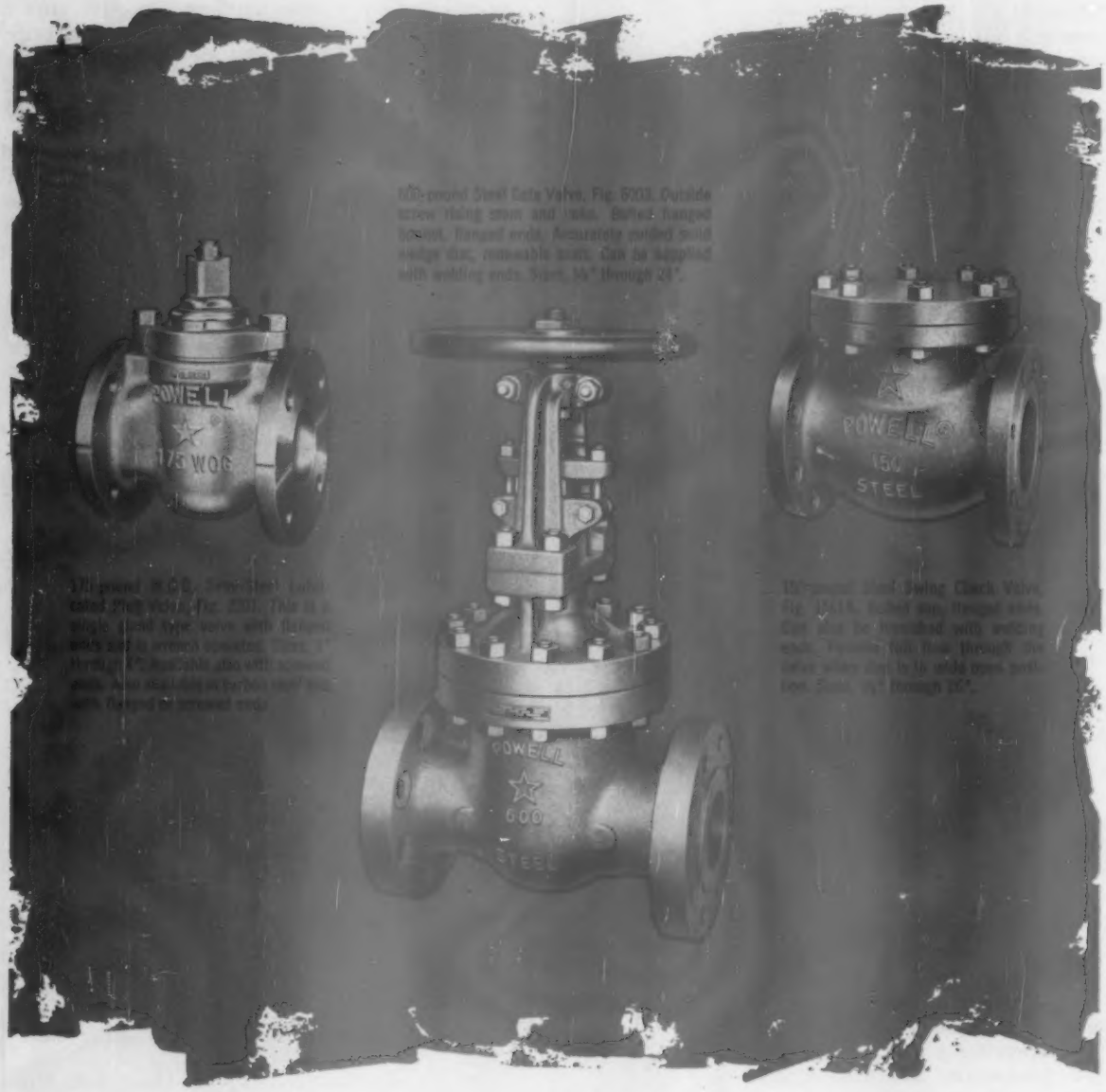

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Iraq's Oil: Is a Settlement Coming?

• It's Kassim's move now. IPC has just made two new concessions in an effort to get talks started again.

Paul Swain
International Editor

DURING the Baghdad summer, when the mercury hovers doggedly around the 120°-mark, the city is hardly the ideal spot to visit. But a top team of oil men would like an invitation.

Iraq Petroleum Co. wants to resume its talks with Gen. Abdul Karim Kassim, the country's wily revolutionary premier. At stake could be the future of the multinational company which produces just about a million barrels of oil a day in Iraq. The future of Iraq as a major Middle East producer could well be at stake, too.

IPC is making two big concessions to Kassim in an effort to get its talks with him started again. They are:

. . . A new team of negotiators which will include some top executives of the international oil companies which share in the ownership of IPC. Kassim became increasingly impatient in past negotiations because IPC people in Baghdad wanted to get instructions from owner companies when thorny points came up in the talks.

. . . Suspension of write-offs of what is now commonly called "dead rent" on concession areas. IPC has been amortizing these rentals at 5% a year and Iraq objects to the practice. Both sides have agreed the dispute should go to arbitration. Kassim angrily suspended the April 6 talks because IPC would not agree to suspend the practice pending an arbitration decision.

The two conciliatory moves were contained in IPC letters to Kassim early this month. He had demanded a "clear written reply" to his points in dispute before he would agree to talk any more. Contents of the IPC letters to Kassim were not made public and the company was still waiting last week for the Iraqi premier to make the next move.

Kassim has demanded a "new deal" with IPC since he led the 1958 revolution which overthrew the Hashemite kingdom, cost the life of King Faisal, and put Kassim in power. The premier says it is time for a change. He doesn't like the terms of the agreement under which IPC has operated in the country since 1952. He wants more for Iraq.

The American-British-Dutch-French companies who own the IPC group of operating companies have indicated a willingness to give a little. But, the points they have been ready to yield have failed to satisfy Kassim.

Over the past 3 years a series of 28 meetings have been held between IPC people and Iraq officials. Several times each side has felt they were getting closer to a solution, but to date nothing has been settled.

Kassim assumed personal charge of the Iraqi side of the negotiations about a year ago. Twice since that time he has released to the Iraqi press and radio complete transcripts of the talks. Each time the companies have come off a decided "second best." The transcripts make the company negotiators appear to be obstinate obstructionists, unwilling to concede what Kassim claims are the "rights" of the Iraqi people. Kassim, on the other hand, emerges as a clever patriot battling strongly for his people.

Such tactics have nurtured a growing school of thought within the international oil industry that Kassim would rather have the IPC disputes as a forum than have a settlement.

The "dead rents" issue . . . Kassim terminated the last round of talks abruptly April 6 with orders that all three of the IPC companies halt exploration in Iraq immediately.

He accused IPC's managing director, G. H. Herridge, of deliberately dragging out the talks so the companies would have time to select the most promising areas of the country to keep when the time comes to give up some acreage. The companies shut down four drilling rigs and called in one geological and five geophysical parties. No exploration has been done in Iraq since that time.

F. J. Stephens
. . . new IPC negotiator.

H. W. (Bud) Fisher
. . . also on IPC team.

Before the premier took this drastic action, the bone of contention at the meetings had been IPC's practice of amortizing, at an annual 5% rate, rentals paid to the government before commercial oil production started in each of IPC's three concessions. The company has written off about $19 million in these rentals and planned to write off another $28 million in future years.

When compared to the annual $275 million which Iraq received from oil (more than 60% of the country's income) the rental amori-

Kassim Lays Claim to Kuwait

AS IF he didn't have enough problems at home, Iraq's Premier Abdul Karim Kassim last week stirred up a minor political flurry in the Middle East by laying a formal claim to Kuwait, his southern neighbor.

With a straight face, the square-jawed Iraqi strong man announced that Kuwait has always been an integral part of Iraq. He added that he planned to issue an order appointing Shaikh Abdullah al-Salim al-Sabah as governor of the "Kuwait District of Iraq."

He warned that the shaikh, easily the wealthiest man in the Middle East, would be dealt with severely as a "mutineer" if he resisted the Iraqi action.

Kassim's move was timed to follow almost immediately the official departure of the British from Kuwait after 62 years as the little shaikhdom's protector. Only a week before, Great Britain abrogated an 1899 treaty and gave the smallest, and richest, Middle East oil producer its full independence. Kuwait has already applied for membership in the Arab League and plans to ask for membership in the United Nations.

Kuwait resists . . . Kuwait's reaction to Kassim's announcement was swift and expected. Shaikh Abdullah said he would stand on his country's newly acquired independence and would fight to defend it if necessary. He didn't mention he has a new agreement with Britain that allows him to call on English naval and military forces for help.

In Baghdad, the Iraqi Foreign Ministry started handing out a memorandum to all diplomatic missions claiming that Kuwait was a part of the Province of Basra when all of Iraq was part of the old Turkish Empire.

"This fact is attested to by history, and no good purpose is served by imperialism's denying or distorting it," the memorandum said.

Premier Kassim

Kassim's action is widely regarded in the Middle East as primarily an effort to beat Egypt's Gamal Abdel Nasser to the punch

zation is pretty small potatoes. But, not to Kassim.

This point has been disputed for more than 2 years and both sides have agreed to submit the question to arbitration. Kassim demanded that the companies suspend the practice pending a final decision. The companies refused unless he would set a definite time limit for the arbitration proceedings. This broke up the April talks.

It was not clear last week whether the companies have suspended the writing off of rentals indefinitely or if they are still asking for a time limit.

The new team . . . When the new team of negotiators goes back to Baghdad—if it gets the expected invitation—it will still have Herridge, the IPC managing director, but it will be beefed up by some top officials from the owner companies, too.

H. W. (Bud) Fisher, a director of Standard Oil Co. (N. J.) and a former IPC managing director, will go along. Fisher's presence in the new group is far more important than would be indicated by the fact that the Jersey company owns less than 12% of the IPC group. Fisher was one of two managing directors of the group when Kassim staged his revolution and is an old hand at dealing with the Iraqis.

Another new negotiator will be F. J. Stephens, only recently elevated to chairman of the board of Shell Transport & Trading. Whether there is any significance in the fact that Stephens is the man who negotiated the Kuwait offshore concession deal in which the company agreed to give Kuwait a 20% interest in the venture remains to be seen. One of Kassim's demands is that the Iraqis be given an ownership interest in the oil industry.

Kassim has long recognized the variety of interests involved in the ownership of the companies which produce oil in his country. Some of IPC's owners have extensive holdings in other Middle East producing countries which could be affected by any change in the status quo in Iraq. At the same time the very variety of ownership makes it difficult, at times, for the company itself to agree on what its policy should be. Both these factors only serve to complicate the negotiating problems.

Ownership of the IPC group of companies is shared equally (23.75%) by Royal Dutch-Shell, British Petroleum Co., Cie. Francaise des Petroles, and Near East Development Co. (owned jointly by Jersey Standard and Socony Mobil). The remaining 5% is owned by the estate of the late Calouste Gulbenkian, the Armenian entrepeneur who negotiated the original oil concessions when Iraq was still part of the Turkish Empire.

Kassim's demands. When Kassim broke off the April negotiations, he demanded what he called a "clear written reply" to his viewpoint before he would agree to talk again.

His "viewpoint" breaks down to 12 basic points, many of them minor and theoretically subject to a not-too-difficult agreement. Half a dozen of his points loom pretty large to an international oil company. Here are the major points of difference as seen by the Iraqi premier:

Arch rivals for Arab world leadership, both would like to control the more than $400 million in oil income which Kuwait gets every year. Arab experts discount any possibility of a military move against Kuwait by Iraq in spite of the fact that Kassim's well-armed, modern, Soviet-equipped army could move easily across the Kuwaiti border.

Help nearby . . . A military move would rally the active support of Saudi Arabia and Nasser's United Arab Republic for Kuwait. Both have already formally congratulated Kuwait on her independence. King Saud also sent Shaikh Abdullah a message of support in which he called Kassim's attitude "strange" and pledged Saudi aid.

There is also little likelihood that Britain would stand idly by and watch Iraq take over Kuwait. The little country produced an average of more than 1,700,000 bbl. of oil daily the first quarter of this year. Half of it is British oil and represents more than 40% of the British supply.

. . . **Costs of production** and exploration which are deducted from oil income before the companies divide their profits with Iraq on a 50-50 basis. This is a bookkeeping problem. Kassim objects to, among other things, the company practice of writing off all exploration and drilling expenses in the year they are incurred. He contends these should be regarded as capital expenditures and amortized at 5% a year.

He objects also to the company practice of charging a part of the expenses of maintaining offices in London to production costs.

. . . **Pricing practices** of the companies draw the premier's fire. He contends that posted prices of Iraq crude bear no relationship whatever to its value and contends that the companies have it in their power to juggle these prices at their own discretion.

He obviously expects the producing countries, acting in concert through the newly organized Organization of Petroleum Exporting Countries (OPEC), to help the middle eastern producers acquire control over prices charged for oil.

. . . **An Iraqi executive director** of the IPC group of companies is another thing Kassim demands. He shrugs off any suggestion that Iraqis named to the board would serve the purpose of keeping the government informed.

. . . **Surrender of concession** area is a prime example of just how near—and yet how far apart—the opposing sides can be in a dispute of this kind. The 1952 agreements with the IPC group of companies have no provisions for the surrender of any of the concession area. Most other Middle East concesison grants do provide for this.

More than 2 years ago, at the demand of the Iraqis, the companies agreed in principle to give up about 90,000 sq. miles. The Iraqis countered with a demand for 100,000 sq. miles and insisted that the government would decide which acreage would be given up. The company insisted—and still insists—on the right to pick the territory it relinquishes.

. . . **Natural gas use** is a point which has drawn the increasing attention of the Iraqi premier since he took over personal direction of the negotiations. He objects strenuously to the fact that IPC flares 96,000 M.c.f. of gas daily and the affiliated Basrah Petroleum flares 150,000 M.c.f. daily. He wants the companies to agree to reinject the gas, give it to the government (which they already do), or compensate the government for its "waste."

. . . **Capital participation** by Iraq in IPC operations is one of Kassim's "musts." He says flatly that the Iraqi Government must be allowed to "subscribe" at least 20% of the company's capital stock. The company negotiators counter that IPC has never issued any stock and its ownership is now fully subscribed.

. . . **A bigger profit share** has always been one of Kassim's prime ambitions. He points to recent agreements in other middle eastern countries which theoretically give governments more than a half-share in oil profits. He wants the same for Iraq.

The company insists that its agreement with Iraq calls for matching any "higher profit per ton" granted any other producer in the area. And, no other Middle East government has received any income from these recent agreements because none of them is producing any oil. This matters little to Kassim. The fact that better deals have been made, whether they are paying off or not, means to him that Iraq should have a better deal right now—and one that pays off.

French Get Their First Libyan Oil Well

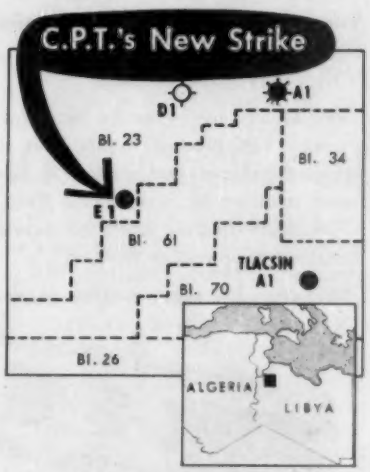
THE French have joined the club of successful Libyan oil hunters with a 1,932-bbl.-daily discovery in the far western part of the country.

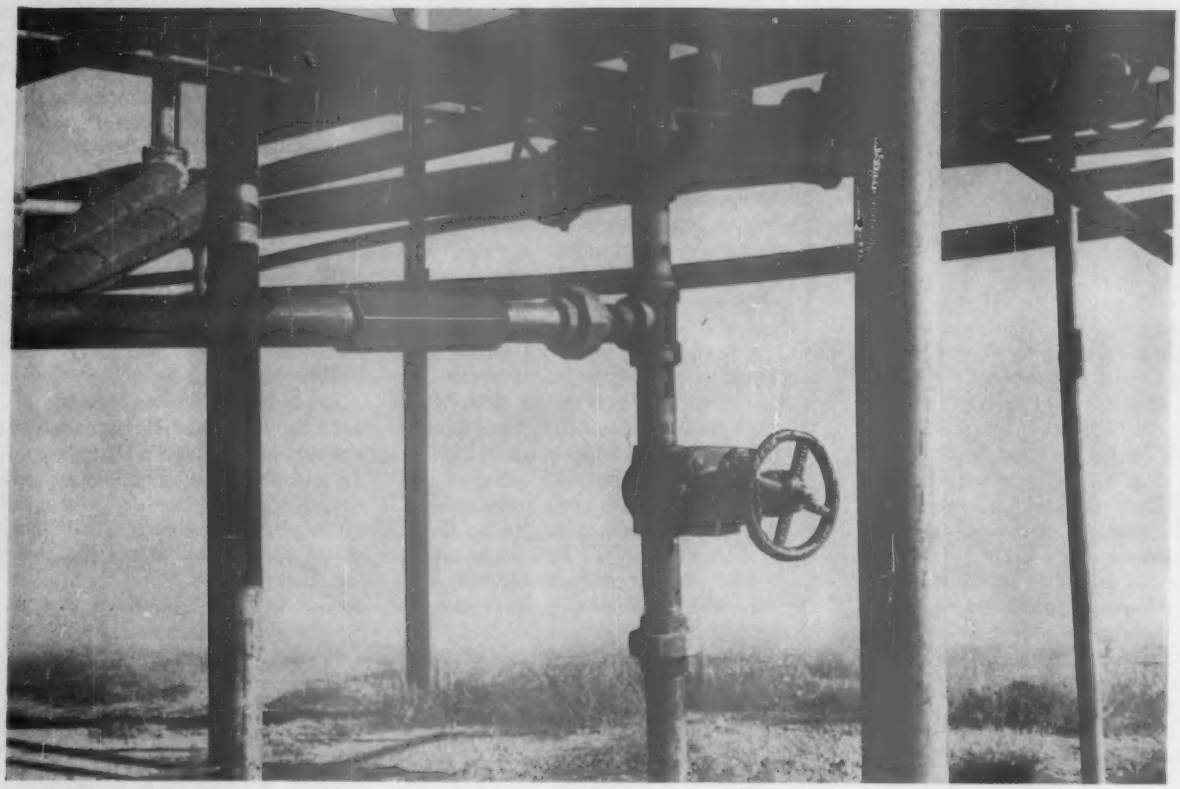
Cie. Des Petroles Total (CPT) encountered the flow of 38°-gravity oil in a pay zone in its E1 at 8,000 ft. in Block 23. The well is about 85 miles from the Mediterranean coast.

CPT hit the promising zone in March (OGJ, Mar. 27, p. 79). But the well was deepened to 11,485 ft. before it was completed as a producing well from the higher zone.

The commercial prospects of a 1,900-bbl. well this distance from the coast probably depends on the areal extent of the field. The find is close to the border of Block 61. This concession also is held by the French company.

Another test on Block 23, the D2, has been abandoned as a dry hole at 6,007 ft. The company is continuing its drilling program on the block.





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- Spot checking flow rates.

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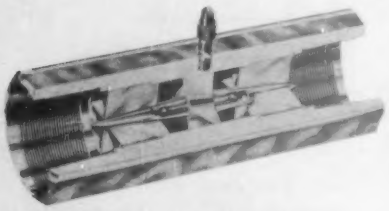

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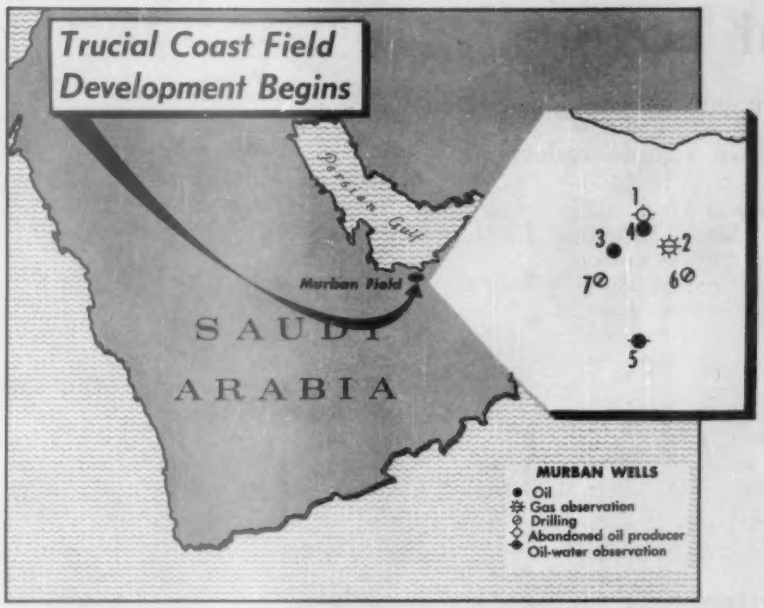

Two Rigs at Work in Murban

PETROLEUM Development (Trucial Coast), Ltd., has two rigs working the east and west flanks of Murban field in the Shaikhdom of Abu Dhabi.

The developer, an affiliate of Iraq Petroleum Co. (IPC), is getting ready to locate a tanker terminal on the Persian Gulf.

Production is in the 8,000 to 9,000-ft. range from a horizon that may possibly be one of the producing zones in Umm Shaiff field in the gulf, the nearest production.

Flow rates of Murban wells drilled so far are not uniform. Petroleum Development has not disclosed test results on individual wells.

Unusual history . . . Murban has tantalized the geological world for years. Murban 1, 10 miles southwest of Tarif, flowed an "appreciable amount of 42°-gravity" oil late in 1953 when the test was around 10,000 ft. The well was later abandoned at 12,588 ft. for mechanical reasons.

Murban 2 was completed as a gas observation well and Nos. 3 and 4 as oil producers.

The key well may have been No. 5, 15½ miles south of Murban 1. No. 5 was completed as an oil-water observation well.

No. 6 and No. 7 are halfway back up the structure toward the discovery.

Petroleum Development still is feeling its way and is uncertain about extent and potential of the reservoir. More locations have been staked.

Terminal survey . . . An intensive hydrographic survey of the sea approaches to Murban has been completed.

The terminal, relatively close to the entrance to the Persian Gulf, will give Murban oil a transportation advantage over tankers loading at other oil ports up the gulf.

Liquid methane deal would give England 700,000 tons yearly

ENGLAND will buy about 700,000 tons of liquefied methane annually under proposals submitted to the country's Ministry of Power. This amounts to 37 billion cubic feet a year.

This volume of French Sahara gas—equivalent to about 350 million therms, or about 1,750,000 tons of coal—is called for in agreements between the U. K. Gas Council, Conch International Methane, and a group of French producing companies. The Gas Council has submitted the contracts to the ministry of power for final approval (OGJ, May 29, p. 108).

The pact climaxed several years of experiments with refrigerated tanker movement of LPG by Conch and predecessor groups.

Two special tankers, each with a capacity of 11,000 tons of liquefied methane, will shuttle between an export terminal at Port Arzew, near Oran, Algeria, to Canvey Island, near London, if the British Government approves the projects.

The gas will come from Hassi R'Mel gas field. It will be liquefied at Port Arzew in a plant built by Conch and French partners. Upon its arrival in England, it will be distributed to seven gas boards in southern England and the Midlands. The gas will be used to enrich supplies of locally produced town gas.

Offshore Moorage Will Handle Zelten Oil

A HUGE mooring facility is under tow this week for offshore Libya to be used in loading tankers with crude from Libya's newly developed oil fields.

Esso Standard (Libya), Inc. is the owner of the device, constructed by Avondale Shipyards, Inc., New Orleans. It will be installed on the ocean bottom just off Marsa el Brega, the Libyan Mediterranean port which will serve as Esso's export terminal (OGJ, May 2, 1960, p. 92).

Neither Esso nor Avondale released information on the facility, but the Journal learned it will serve as a substitute for a harbor or docks.

The structure contains a large crane with a boom nearly 600 ft. in length. Crude piped from storage tanks onshore will move to the facility and along the boom directly into the tanker.

The facility began its ocean voyage from New Orleans on June 1 and should arrive at its destination around August 1.

Esso is building a 100-mile, 30-in. pipeline to the terminal from its prolific Zelten field south of Marsa el Brega.

World Output Lower

- **Free-world production falls into summer slump in April. Kuwait, Venezuela have sizable reductions.**

FOREIGN production dipped sharply in April.

The end of cold weather brought production cutbacks of 212,800 bbl. daily in Venezuela and 301,900 bbl. daily in Kuwait.

The month also marked the end of constant upward growth in Algeria and Argentina. French Saharan output, down 11,900 bbl. daily to 327,500 bbl. daily, had virtually the first monthly decline since the Hassi Messaoud pipeline started taking crude in September 1959.

Argentine output slid 15,400 bbl. daily in the months since January, after a steady growth throughout 1960.

Western Europe continued to inch forward, with record production in West Germany, and near record production in the Netherlands, France, and Italy.

TREND OVER THE LAST YEAR
(Thousands of barrels)

	Western Hemisphere less U. S.	Middle East	Total free world outside U. S.
1960			
April	4,053.7	4,925.2	10,027.9
May	4,317.4	5,286.2	10,680.2
June	4,285.4	5,164.5	10,568.2
July	4,214.2	5,103.5	10,448.2
August	4,420.1	5,146.8	10,602.5
September	4,311.3	5,500.2	10,941.3
October	4,243.9	5,630.6	11,104.5
November	4,206.8	5,482.2	10,964.2
December	4,341.2	5,550.1	11,152.2
1961			
January	4,594.1	5,568.1	11,418.8
February	4,616.9	5,697.7	11,572.8
March	4,448.6	5,764.1	11,510.1
April	4,272.9	5,386.7	10,961.5

World-Wide Crude Production: Daily average in Thousands of Barrels

Country—	Apr. 1961	Mar. 1961	Apr. 1960
Western Hemisphere			
Argentina	223.3	233.2	156.3
Bolivia	7.4	7.7	7.9
Brazil	92.0	92.0	77.0
Canada	565.0	516.0	489.8
Chile	21.9	21.9	19.1
Colombia	145.9	147.6	157.9
Cuba	0.2	0.2	0.3
Ecuador	8.3	8.3	7.5
Mexico	274.0	274.0	251.5
Peru	52.8	52.8	51.5
Trinidad	126.5	126.5	119.1
Venezuela	2,755.6	2,968.4	2,715.8
Total	4,272.9	4,448.6	4,053.7
Europe			
Austria	44.7	44.7	46.8
France	40.7	40.5	37.9
West Germany	117.0	116.2	110.4
Italy	37.4	34.4	30.0
Netherlands	39.3	39.4	34.8
United Kingdom	1.7	1.7	1.7
Yugoslavia	24.4	24.4	11.5
Total	305.2	301.3	273.1
Middle East			
Bahrain	45.0	45.1	45.0
Iran*	1,051.0	1,096.0	974.0
Iraq†	975.0	945.0	925.9
Israel	2.3	2.3	2.3
Kuwait	1,566.3	1,868.2	1,459.3
Neutral Zone	153.4	151.4	131.4
Qatar	174.3	177.0	169.8
Saudi Arabia	1,412.4	1,472.1	1,210.6
Turkey	7.0	7.0	6.9
Total	5,386.7	5,764.1	4,925.2
Other Asia			
British Borneo	90.0	90.0	95.3
Burma	10.5	10.5	9.7
India	8.5	8.5	8.5
Indonesia	421.2	414.2	420.9
Japan	12.2	12.2	9.1
New Guinea	3.3	4.0	4.3
Pakistan	5.9	5.9	5.9
Total	551.6	545.3	553.7
Africa			
Algeria	327.5	339.4	126.1
Angola	1.5	1.5	1.2
Egypt	71.7	71.7	61.8
Middle Congo	2.1	2.0	.....
Gabon	15.0	14.9	15.0
Morocco	1.7	1.7	2.1
Nigeria	25.6	19.6	16.0
Total	445.1	450.8	222.2
Free World			
Foreign	10,961.5	11,510.1	10,027.9
United States	7,328.2	7,470.8	7,038.0
Total	18,289.7	18,980.9	17,065.9
Communist Countries in Soviet Orbit			
Romania	234.0	231.0	234.0
Russia	3,170.0	3,170.0	2,850.0
Other Communist	100.0	100.0	100.0
Total	3,504.0	3,501.0	3,184.0
WORLD TOTAL	21,793.7	22,481.9	20,249.9

Figures are from reliable industry reports or government sources. Estimates are made where complete reports are lacking. *Includes estimated 6,000 bbl. daily from Naft-i-Shah field not operated by consortium companies. †Includes production from Naft Khaneh field, operated by Iraq Government.

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You can engineer cementing operations to

eliminate wasteful WOC time

A generous bonus in rig time awaits adoption of latest thinking about "waiting on cement" time, these authors declare. Usual WOC time is now about 24 hours. Recent field and lab tests show that 8 hours is usually enough. If cements are carefully chosen, they develop needed strength and thickening well within the 8-hour period.

BY WILLIAM G. BEARDEN
AND ROBERT D. LANE
Pan American Petroleum Corp., Tulsa

THE OIL INDUSTRY has come a long way in cutting down its waiting-on-cement (WOC) time. Today, 24 hours is the usual average.

Our tests show that cements can be selected so they have adequate thickening time and tensile strength far sooner. With a good cementing program, the entire operation, including mixing and pumping cement and WOC time, should rarely exceed 8 hours.

If WOC time can be cut from 24 to 8 hours, the industry would save 16 hours on each of the 45,000 wells completed in this country annually—even if only one cement job is performed per well. Gross savings would be approximately 30,000 rig-days per year.

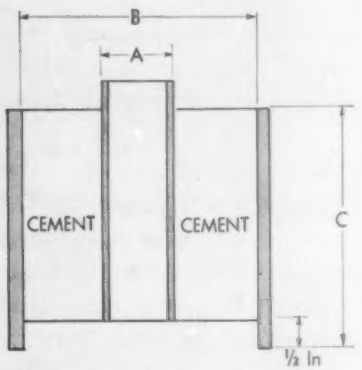
Of course such rig operations as nippling down, nippling up, and running logs must follow the cement job. These can be completed in less time than usual WOC periods. We believe rig operations can be revised to take advantage of the 8-hour WOC time we propose.

These conclusions are the result of an extensive field and laboratory study. As part of this study we found that only 8 psi. tensile strength in the cement is usually adequate to support the casing. And we can select cements which at bottom-hole conditions have adequate thickening time and still develop 8 psi. in less than 8 hours after mixing.

Laboratory Strength Tests

To find how much strength is required of cements, we made a series of tests to determine the ability of an annular ring of cement to support casing. Tests were on several types of cement cured in the annulus between two pipes ranging from 1.3 to 8.625-in. o.d. and from 4 to 16-in. in length.

The cements were poured into the specimens shown on Fig. 1 and into conventional tensile-strength briquette molds. After curing the specimens under water, we measured the force required to move the inner



SUPPORT given by cement was measured on this specimen. Measure was made of force necessary to cause movement between cement and pipes. Dimensions are listed on Table 1. Fig. 1.

This paper was originally presented by the authors under the title, "Engineered Cementing Operations to Eliminate WOC Time," at the API Division of Production Mid-Continent 1961 district meeting, Tulsa.

TABLE 1—EFFECT OF CASING DIAMETER AND LENGTH ON SUPPORT COEFFICIENT

Test No.	API class of cement	Tensile strength (psi.)	Casing size: O.d. of inside pipe (in.) (A)*	Casing size: I.d. of outside pipe (in.) (B)*	Length (in.) (C)*	Force to break the cement bond (lb.)	Support coefficient (psi.)
1	A	18	1.301	2.05	4	196	13.7
			2.375	3.50	4	381	14.6
			5.5	8.00	4	907	15.0
2	A	33	1.301	2.05	4	580	40.5
			2.375	3.50	4	1,160	44.4
			5.5	8.00	4	2,805	46.4
3	A	75	1.301	2.05	4	1,320	92.3
			2.375	3.50	4	2,920	112
			5.5	8.00	4	6,225	103
4	C	7	2.375	4.89	4	131	5.0
			2.375	4.89	8	199	3.6
			2.375	4.89	16	843	7.3
5	C	28	2.375	4.89	4	640	24.5
			2.375	4.89	8	1,690	30.2
			2.375	4.89	16	3,810	32.9
6	C	71	2.375	4.89	4	3,800	146
			2.375	4.89	8	5,860	105
			2.375	4.89	16	12,925	112

*See Fig. 1.

pipe with respect to the cement. This force we called the "force to break cement bond."

To correlate results, the force to break cement bond was divided by the area of the casing contacted by the cement (the area over which slippage occurs). From this, we found the cement "support coefficient" in psi. Tensile strengths were measured from the briquette specimens.

Effect of diameter, length. We made a series of six tests to find the effect of casing diameter and length on the ability of cement to support casing. For this, we used specimens as shown on Fig. 1 and a neat API Class A cement and a Class C cement.

Table 1 shows dimensions of the specimens and the resulting support coefficients. It also shows in tests 1, 2, and 3 the effect of casing diameter. At any constant strength of cement, the force to break cement bond increased with increasing diameters of the inner casing. However, regardless of casing diameter, the support coefficient is relatively constant.

Effect of casing length is illustrated in Tests 4, 5, and 6 of Table 1. For any cement strength, the force to break cement bond increases with increasing casing length. Again, the support coefficient is relatively constant.

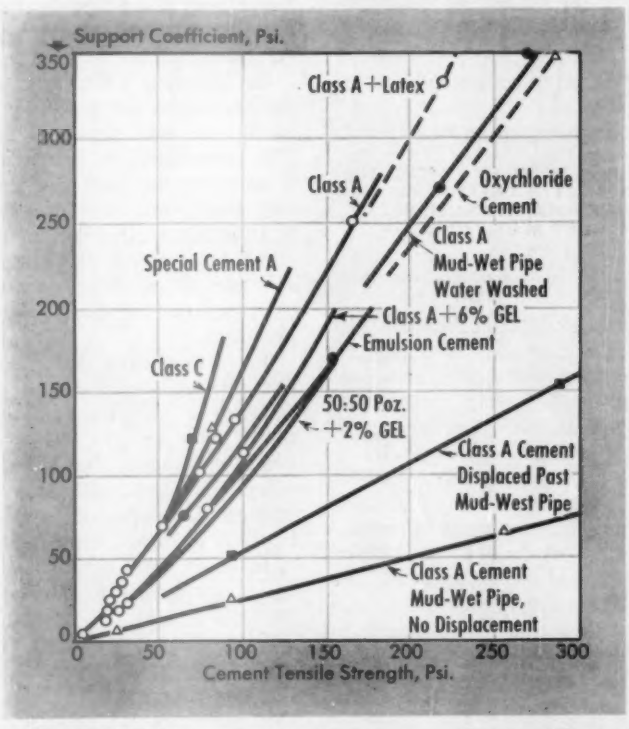
From these results, we concluded that the ability of a cement to support the weight of casing is directly proportional to the area of contact between the cement and the casing.

Type, strength of cement. Table 2 lists results of tests on the effect of cement type and strength on its ability to support casing. Fig. 2 plots these results. The tests were performed on at least three sizes of specimens as shown on Table 1. The support coefficients are averages.

We concluded that the ability of a cement to support the weight of casing increases proportionally with tensile strength of the cement. There are no large differences between types of cements.

Fig. 2 shows that the two cements having the highest support coefficients were an API Class C and a special low-density cement (Special Cement A). Both types are finely ground. This suggests that the finer the grind, the closer cement adheres to minute irregularities on the surface of casing, thereby increasing surface area in contact.

Results were poorer with two cement compositions sometimes claimed to improve bonding. These two were in a Class A cement plus a latex emulsion, and the oxychloride cement. These had no higher support coefficient for the corre-



CEMENT'S ABILITY to support casing goes up directly with tensil strength of the cement. Note that there are no large differences among types of cement. Fig. 2.

TABLE 2—EFFECT OF TYPE AND STRENGTH OF CEMENT ON ITS SUPPORT COEFFICIENT

Test No.	Cement	Tensile strength (psi.)	Support coef. (psi.)
1	API Class A	4	5.35
2	API Class A	18	14.4
3	API Class A	23	26.8
4	API Class A	33	43.8
5	API Class A	53	68.1
6	API Class A	75	102
7	API Class A	83	122
8	API Class A	96	133
9	API Class A	164	251
10	API Class C	7	5.3
11	API Class C	28	29.2
12	API Class C	71	121
13	50-50 Pozzolan-Class A + 2% Bentonite	33	25.9
14	50:50 Pozzolan-Class A + 2% Bentonite	154	170
15	Class A + 6% Bentonite	8	4.8
16	Class A + 6% Bentonite	27	19.9
17	Class A + 6% Bentonite	81	79.0
18	Class A + 6% Bentonite	101	112
19	Special Cement A	6	3.8
20	Special Cement A	14	15.5
21	Special Cement A	28	35.1
22	Special Cement A	83	127
23	Kerosine Emulsion Cement§	24	23.6
24	Kerosine Emulsion Cement§	77	80.1
25	Kerosine Emulsion Cement§	156	172
26	Class A + 0.7 gal. per sack Latex Emulsion	218	333
27	Magnesium Oxychloride Cement	285	349
28	Class A*	90	52.1
29	Class A*	217	90.0
30	Class A*	275	154
31	Class A†	64	76.0
32	Class A†	217	271
33	Class A†	272	350
34	Class A‡	25	6.4
35	Class A‡	96	26.0
36	Class A‡	256	64.8

*Mud-wet casing; cement flowed past casing prior to pouring. †Mud-wet casing; water flowed past casing prior to pouring. ‡Mud-wet casing; mud layer not disturbed prior to pouring. §48% cement, 22% kerosine, 30% water.

sponding tensile strengths than did the neat API Class A cement.

Tests were also made on kerosine-emulsion cement (Tests 23, 24, and 25 of Table 2). Purpose was to determine if a hydrocarbon in the cement would make the casing oil-wet, and thereby decrease bond with the cement. Although the casing appeared oil-wet, support coefficients were not appreciably lower than with other cements.

Effect of mud. We made three series of tests on effect of mud on casing-support coefficient. In all tests the inner pipe stood in a bentonite water-base mud for 1 hour. In the first series of tests, the inner pipe was removed from the mud and a cement slurry flowed past at velocities like those in the field. Then, the pipe was placed in the outer pipe as shown on Fig. 1.

A Class A cement was then poured into the specimens, cured, and tested for support coefficient. Results are shown as Tests 28, 29, and 30 in Table 2 and are plotted on Fig. 2. The support coefficient for mud-wet casing varied linearly with tensile strength of the cement and was somewhat less than with plain pipe as in Tests 1 through 9.

In the second series of tests on mud-wet casing, we used much the same procedure. However, after removing the pipe from the mud, water was flowed past to simulate a water wash ahead of the cement. Results are shown as Tests 31, 32, and 33 in Table 2. The water wash removed essentially all mud from the casing. For this reason, support coefficients are similar to those with plain pipe. These tests show the advantage of a water wash ahead of the slurry to increase ability of cement to support casing.

The third series of tests were to determine the lower limit for support coefficients in mud-wet casing. In these tests, we made no attempt to remove the mud layer from the pipe prior to pouring the cement. Results are shown as Tests 34, 35, and 36 in Table 2.

Fig 2 shows that the support coefficient for the mud-wet casing (no displacement) varies linearly with the cement tensile strength. Thus,

$$S = \frac{F}{12\pi d_c L} = (0.257)\,ts \qquad (1)$$

Where:

S = support coefficient, psi.

F = force to break the cement bond, lb.

d_c = outside diameter of casing, in.

L = length of casing, ft.

ts = tensile strength of cement, psi.

Supporting casing. We calculated the effectiveness of cement at 8 psi. tensile strength in supporting the weight of casing using Equation 1. Table 3 shows the results in terms of the length of pipe supported by a 10-ft. column of cement.

We can use the relationship between support coefficient and tensile strength. It can enable us to determine the strength of cement or height of cement column required to support any given casing string. For this, we use the following equation:

$$ts = \frac{(L)\,(w)}{9.69\,(d_c)\,(h_c)} \qquad (2)$$

Where:

ts = tensile strength of cement, psi.

L = length of casing string, ft.

w = weight of casing, lb. per ft.

d_c = outside diameter of casing, in.

h_c = height of cement column, ft.

We computed, using Equation 2,

TABLE 3—LENGTH OF CASING SUPPORTED BY A COLUMN OF 8-PSI-TENSILE-STRENGTH CEMENT 10 FT. LONG

Casing o.d. (in.)	Casing weight (lb./ft.)	Length supported by 10 ft. of cement
4½	9.5	367
	11.6	301
	13.5	258
	15.1	231
5½	15.5	275
	17.0	251
	20.0	213
	23.0	185
7	20.0	271
	26.0	209
	32.0	170
	38.0	143
8⅝	32.0	209
	36.0	186
	40.0	167
	44.0	152
10¾	40.5	206
	45.5	183
	51.0	163
	55.5	150

a cement job of 9,000 ft. of 10¾-in. 45.5-lb. per ft. casing. With a cement fill of 1,000 ft., the cement need have tensile strength of only 4 psi. Thus, low tensile strength is adequate to support the weight of casing.

Cement of low strength withstand the shock of perforating better than do cements of high strength. Also, the ability of a cement to withstand the shock of drilling depends upon drilling practices. That is, if only drill-collar weight is used in drilling the plug and enough hole to bury the collars, the cement needs only 50 psi. compressive strength (5 to 10 psi. tensile strength).

Finally, the ability of a cement to segregate formations depends more upon quality of the job (removing excess mud and placing a complete annular ring of cement around the casing) than on strength of the cement.

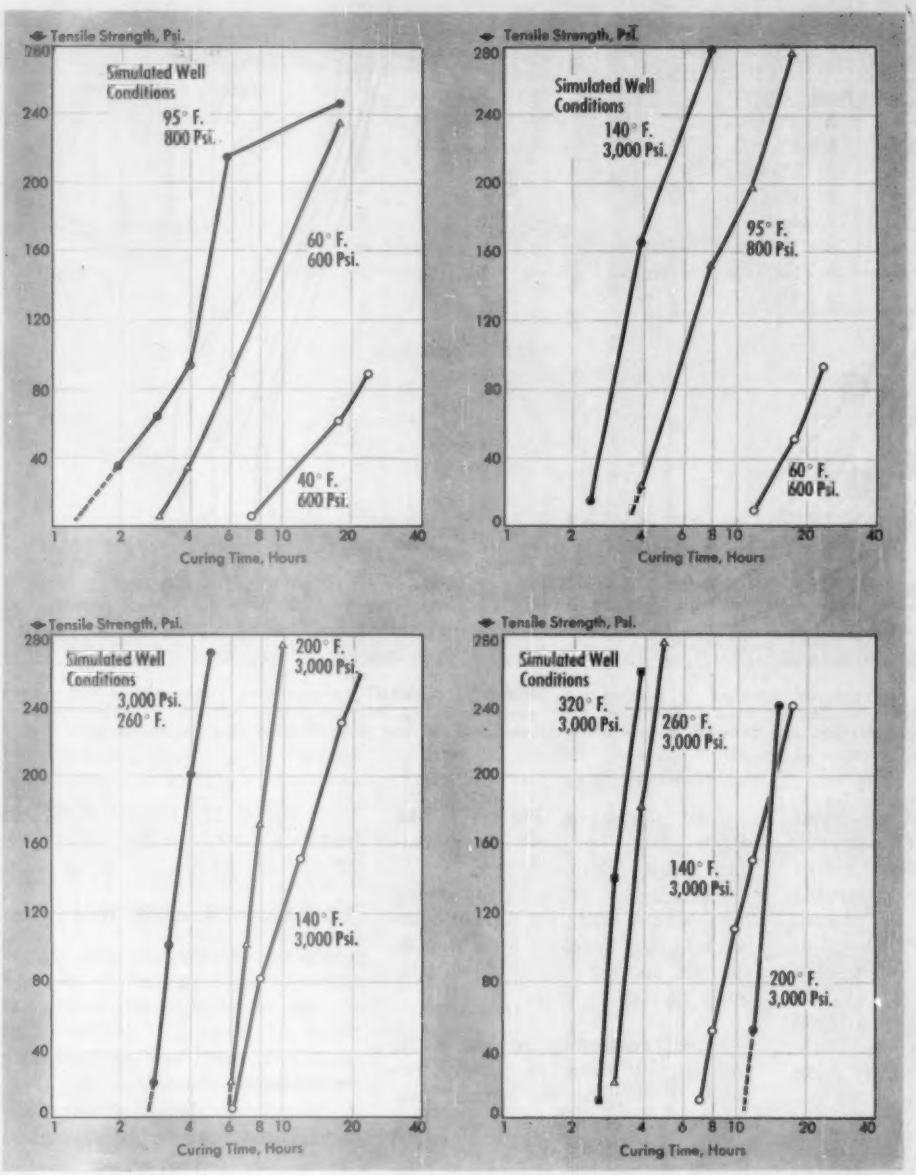
Strength of cements. Low tensile strengths were proved adequate for supporting casing and for fixing minimum WOC times. Next step was to evaluate the early strength of various oil-well-cementing compositions under simulated well conditions. For this, we used the "Well-Simulation Test Schedules for Curing Strength Specimens" given in API RP 10B.

In following these schedules, the specimens are placed in water at 80° F. and pressures applied. The temperature is increased over 4 hours to the final test temperature which varies from 95° to 350° F. In addition, other specimens were cured at constant temperatures of 60° and 40° F. A pressure of 600 psi. was used at these lower temperatures.

Fig. 3 plots early strength of various oil-well-cementing compositions. The significant features of these plots are (1) the rapid increase of strength after strength development begins, and (2) how soon strength development begins, particularly at higher temperatures.

In these tests, most Class E cements are slower to develop early strength at 200° F. than at either 140° or 260° F. The high strengths after little curing strongly suggest that we can use less WOC time than currently.

To eliminate WOC times, the cement must develop adequate



STRENGTH DEVELOPMENT for four API cements. Upper left is Class A with 2% calcium chloride; upper right is plain API Class A. Lower left is Class D and lower right is API Class E. Fig. 3.

strength in less time than required by necessary rig operations. We think our laboratory investigation can serve as a basis for such a plan. For this purpose, we must accept a tensile strength of 8 psi. as adequate to allow rig operations to be resumed. If we cross-plot the strength data, we can find the length of time required for a cement to develop this strength. Shortest WOC times will result with the cement which most quickly attains 8 psi. tensile strength.

Time to develop strength. Fig. 4 shows the time required to develop 8-psi. tensile strength for several brands of Class A cement with and without additives such as calcium chloride, bentonite, and pozzolans. At static bottom-hole temperatures of 60° F. or higher, Class A cement plus calcium chloride develops 8-psi. tensile strength in 7 hours or less.

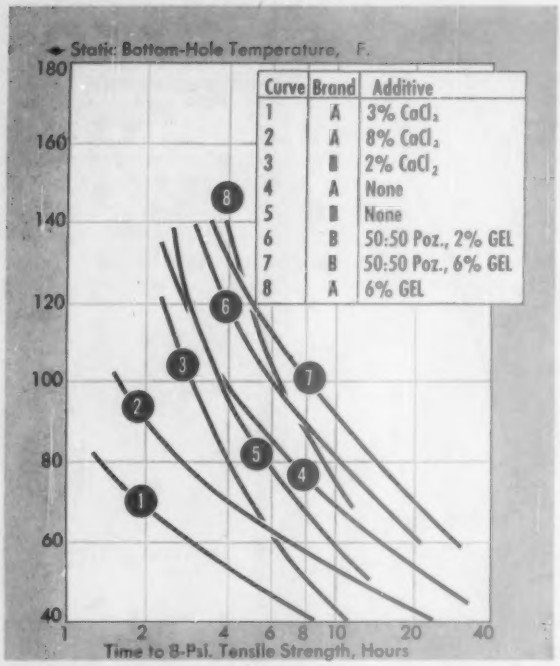
At 80° F. or higher, most Class A cements without calcium chloride develop this strength in 7 hours or less. Additives such as bentonite and pozzolans generally prolong the time to develop 8-psi. strength.

Fig. 5 shows a similar plot for deep - well cementing compositions. Slow-setting cements require somewhat longer time to develop 8-psi. strength than do Class A cements shown on Fig. 4. Still, 10 hours is adequate for most well conditions. You can select cements which can develop 8 psi. in less than 7 hours.

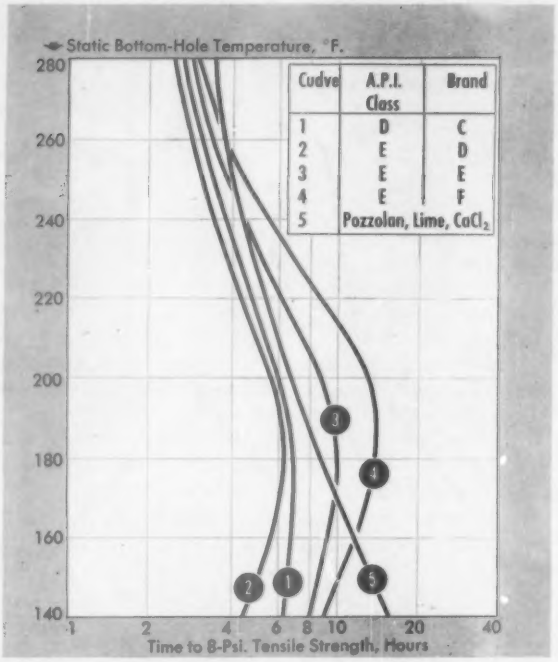
Above 240° F., 5 hours is generally sufficient. All three Class E cements we tested tend to develop adequate strength more slowly at 180° to 200° F. than at either 140° or 200° F. This reversal requires us to know accurately both static bottom-hole temperatures and performance characteristics of the cement.

We found no such strength reversal on either the Class D cement or the pozzolan-lime blend.

Thickening time. In some cement, 8-psi. tensile strength develops in



TIME FOR 8-PSI. tenslie strength to develop is plotted for several common cementing compositions. Additives such as bentonite and pozzolans prolong strength development. Fig. 4.



DEEP-WELL CEMENT compositions show a temperature reversal, gaining strength more rapidly at high temperatures and at low temperatures than in midrange. Fig. 5.

3 to 7 hours. The most important factor in selecting oil-well cements, however, is thickening time. Cement must obviously remain pumpable long enough for it to be placed.

We used a recent API survey to determine minimum thickening-time requirements. This survey of 325 casing-cementing jobs was regrouped into 2,000-ft. depth brackets. Then, cumulative frequency - distribution curves were plotted for total cementing times. The job time of 90% frequency-distribution curves were plotted for total cementing times. The job time of the wells was then plotted against depth and best-fitted with a straight line. A 1-hour safety factor was added to this line to get the "minimum thickening-time requirement" line shown on Fig. 6.

Once we have the minimum thickening-time requirement, we can find the thickening - time - depth limit of any particular composition. This we do by plotting the thickening-time-depth relationship to its intersection with the thickening - time - requirement line. Thickening time for five of the cementing compositions shown on Figs. 4 and 5 are plotted on Fig. to illustrate this procedure.

Also shown on Fig. 6 is the depth - static bottom-hole-temperature relationship used here.

Knowing the limits on thickening time, we can select the cement composition that develops 8-psi. tensile strength soonest and still has adequate thickening time.

Typical cementing program. WOC time usually means the interval between mixing of the cement and drilling out or resuming other rig operations. Under our plan, WOC time is divided into two phases. The first is the time required to place the cement, i.e., to mix, pump, and displace the slurry to the bottom.

Second phase is the time for the cement to develop 8-psi. tensile strength as determined from curves similar to Figs. 4 and 5. This time begins after the top cement plug bumps. Thus, total WOC times equals the time to bump plug plus the time to develop 8-psi. strength.

Fig. 7 shows a typical cementing program to minimize WOC time. We assume placement time is the maximum total cementing time for 90% of all wells. The time to develop strength is the time to 8-psi. strength as shown on Figs. 4 and 5. The thickening-time-depth limit is from Fig. 6. The longest WOC time required between static temperatures of 43° and 280° F. is only 8 hours.

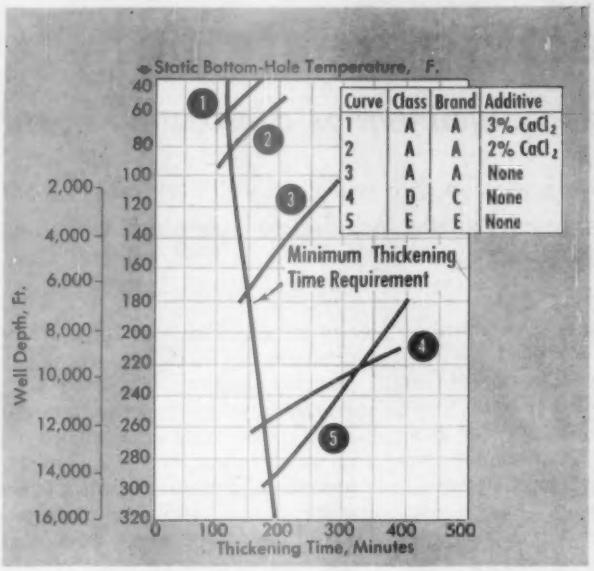
Field Use of Reduced WOC Times

Along with the lab work, we also surveyed field operations to see if it was practical to cut WOC time from 24 hours to 12 hours. This survey included wells in nine states and Alberta, Canada.

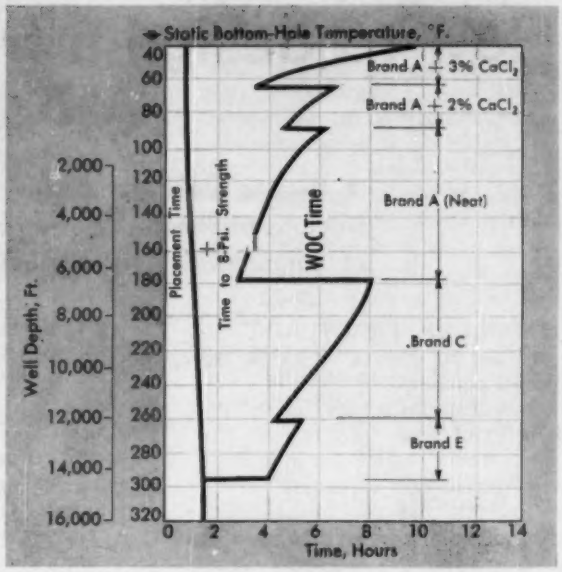
The survey showed that rig operations could usually be revised for a 12-hour WOC time. In some areas, operations could be started after waiting only 6 to 8 hours. To do this meant using a few special practices. For one, reliable float equipment is necessary. The floats eliminate the need to close in the casing following cementing. There are two big advantages from not closing in casing.

First, operations such as nippling up or landing the casing can be resumed immediately and drill pipe run into the hole to drill at minimum WOC time.

A second major advantage is that fluids inside the casing are not expanded by heat of hydration of the cement. If the casing is shut in, pressure increases and the casing


Static Bottom-Hole Temperature, F.
Curve | Class | Brand | Additive
1 | A | A | 3% CaCl2
2 | A | A | 2% CaCl2
3 | A | A | None
4 | D | C | None
5 | E | E | None
Minimum Thickening Time Requirement
Well Depth, Ft.
Thickening Time, Minutes

DEPTH LIMITS are put on cements by the time it takes them to thicken. Minimum thickening time includes a one hour safety factor. Figures are from 325-well survey. Fig. 6.



FOR MINIMUM WOC TIME, here is is typical cementing program. With this program, longest WOC is 8 hrs. At many depths, it is even less. Fig. 7.

expands over its size under normal producing conditions. The cement then sets around the expanded casing. When pressure is relieved, the pipe contracts, leaving a small crack between casing and cement. This cracking or parting frequently causes our inability to segregate one section of a formation from another.

Use of pressure as a method to indicate WOC time destroys the bond between cement and casing. In addition, the extreme high pressure developed can part the pipe.

"Nippling up." The field survey revealed that where pressure was held on the casing, nippling up did not start for as long as 24 hours. Float equipment eliminates the need for holding casing pressure, and nippling up can begin immediately after the plug bumps.

The ideal plan would be to revise casing operations to eliminate nippling up after normal cementing. For this, wellhead equipment would have to be revised. A special casing bowl would have to be installed on the surface casing when it is run. The support mechanism of later strings would pass through the blowout preventer and seat in the wellhead casing bowl.

Pressure testing. Our analysis indicates that pressure testing after cementing has few benefits. Success or failure of the cement job is not positively proved by the test. Primarily, the couplings of the casing are tested. If leaks show, we can't often tell whether they are through couplings or through the float equipment.

On the other hand, we can do a lot of damage from pressure testing after cementing. High pressure inside the casing puts the cement around the casing in radial compression. Since cement strength is low after very short WOC times, this stress may damage the cement or the cement-casing bond. Casing subjected to high internal pressures tends to buckle, placing the pipe in tension. This may cause the cement to fail in shear.

Dangers involved. A short WOC time may have several hazards. First, if casing is not shut in, we depend fully on the float equipment to prevent backflow of cement. However, we can check the float equipment for backflow after the job. If the equipment holds for 30 minutes, we can assume it will hold

A second hazard is selection of a proper cement. The cement must have the right strength development at static bottom-hole temperature.

WOC times based on cement of 8-psi. tensile strength are intended to do more than eliminate nonproductive rig time. They are to provide maximum protection at the earliest possible time. Just because we accept low early strengths as adequate to support the casing does not imply we accept low-ultimate-strength cements. We can get both low early strength and high ultimate strength if we select a good cement composition for the well under consideration.

Where we can save. Since our tests show cements develop adequate strength to allow operations to resume much sooner than current WOC practices, the phrase "waiting on cement" becomes a misnomer. The industry is not waiting on cement. The question is, "What are we waiting on?" In most areas, regulatory bodies require longer waits than the maximum of 8 hours shown on Fig. 7. The responsibility to change the regulations lies with the oil industry. And, such steps are now being taken in many Texas fields.

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How to design a fracture treatment

—using aluminum as a propping agent

• Here is some quantitative information that will help you "engineer" your fracture treatments. Some design curves are included to give quick estimates of conditions for various conditions.

BY T. K. PERKINS, L. R. KERN, AND R. E. WYANT
Atlantic Refining Co., Dallas

HYDRAULIC FRACTURING results are not always up to the expected potential.[1 2 3 4 5]

Low capacities have limited the benefits of many fracture jobs. Result is a renewed interest in increasing fracture flow capacities.[6 7 8]

Recently the use of aluminum pellets as a propping agent has been brought to the industry's attention.[9 10] Reports have been made on both laboratory and field tests.

This article describes the concepts, techniques, and design methods that have been developed for the aluminum propping process.

Fracture conductivities. A partial monolayer of propping material will often result in a high fracture conductivity, Fig. 1. The width of the sparsely propped crack may be less than the width of the fully packed crack. Nevertheless, the fluid flows **around** the sparsely placed particles with greater ease than it can flow **through** the full pack. Under favorable conditions, this yields a conductivity 10 to 100 times that of the fully packed crack.

As fluid pressure diminishes after fracturing, the fracture walls tend to close but are held apart by the propping material. This puts a high pressure or load on the propping particles, which may result in one of two things:

- The propping material may crush into small particles, giving a smaller fracture width with a lower conductivity than desired.
- If the particles do not crush, then they may be forced into the formation walls for some distance resulting in a narrower and therefore less-conductive fracture.

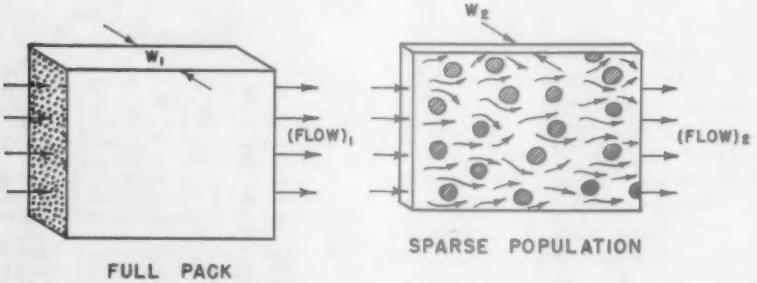
Aluminum particles tend to overcome these difficulties. As a high load is applied to the particles, they will deform. But they will not shatter. This deformation results in a larger bearing area against the formation wall, which reduces the tendency to penetrate the formation.

Fracture conductivities for a variety of conditions have been calculated by a method described previously.[9] Fig. 2 shows conductivities in a hard sandstone for different concentrations of aluminum particles.

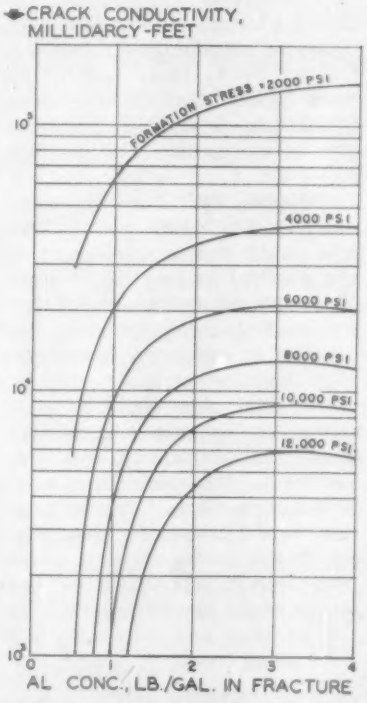
Concentration of particles. In Fig. 2 the concentration of aluminum is given in pounds per gallon **in the fracture.** How can the concentration of aluminum in the fracture be determined? There are several approaches, and one way is to inject aluminum at low concentration and allow the particles to be concentrated as fracturing fluid leaks into the formation. For such a scheme, the concentration of injected aluminum would have to be varied throughout the treatment to get uniform concentration in the fracture.

We think a more practical solution is to make the leakoff of the pellet-carrying fluid negligible. To do this, we inject a spearhead of fluid containing a leakoff-control agent. This fluid creates the desired fracture area, plasters the walls with a filter cake, and thus limits fluid leakoff. The fluid which carries the

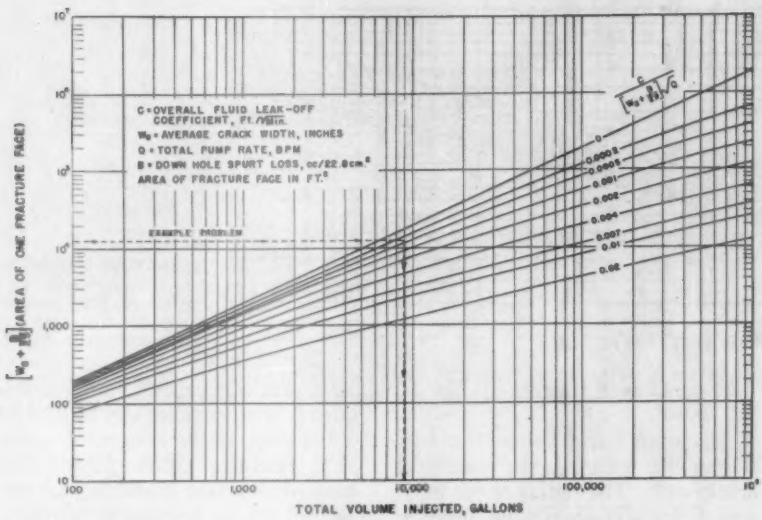
Paper presented at the spring meeting, Southern District, API, production division, Dallas, 1961, under the original title: Designing Aluminum-Pellet Fracturing Treatments.



FRACTURE CONDUCTIVITY depends on density of propping agent as well as on size of the fracture. In this sketch, flow$_2$ > flow$_1$ even though $W_1 > W_2$. Fig. 1.



TYPICAL RELATIONSHIP between fracture conductivity and propping agent concentration. This set of curves is for a 12-16-mesh aluminum pellets in a hard sandstone. Fig. 2.


C = OVERALL FLUID LEAK-OFF COEFFICIENT, FT./√MIN.
W_0 = AVERAGE CRACK WIDTH, INCHES
Q = TOTAL PUMP RATE, BPM
B = DOWN HOLE SPURT LOSS, cc/22.8cm²
AREA OF FRACTURE FACE IN FT.²
EXAMPLE PROBLEM
$\left[W_0 + \frac{B}{\pi}\right]$ AREA OF ONE FRACTURE FACE)
TOTAL VOLUME INJECTED, GALLONS

FAMILY OF CURVES showing relationship between volume of fluid injected and size of fracture generated. Fig. 3.

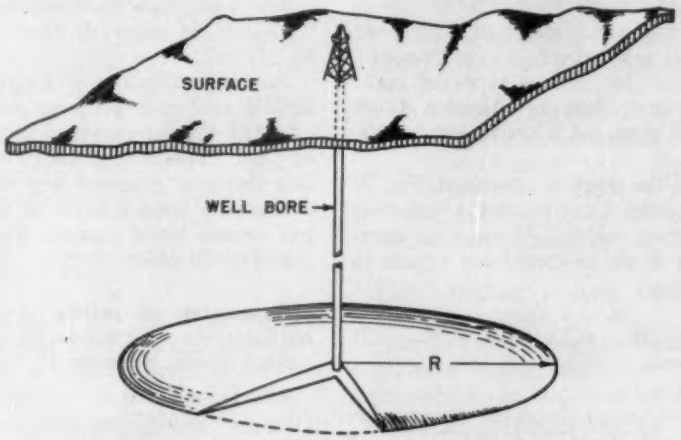
aluminum (and which also has a low fluid loss) is injected after the filter cake has been deposited. If a good filter cake is deposited, the concentration of particles in the fracture will be essentially equal to the concentration injected.

The size of the leakoff-control spearhead can be calculated by considering the leakoff properties of the fluid as presented in a paper by Howard and Fast.[11] A convenient graphical solution of the Howard-Fast equation is shown on Fig. 3. The volume of spearhead fluid needed to create a desired fracture area is easily estimated from this figure. An example problem is presented later.

Crack width. Since we want to inject relatively large particles, we must assure relatively wide fractures. We believe that the width of a fracture can be controlled to some extent. Our studies have resulted in crack-width equations which we have used successfully for several years. These studies show that the width of a fracture is influenced by vertical and horizontal fracture orientation.

Fig. 4 shows a fracture oriented vertically and restricted more or less to the thickness of the pay zone. We believe this orientation predominates in normal fracturing, particularly below about 3,000 ft. Fig. 5 shows a horizontal fracture extending uniformly in all directions. This orientation occasionally will be encountered, particularly at shallow depths or possibly deeper if some initiating device is used.

For vertical fractures the maximum fracture width at the well bore is given by Equation 1. This equation was derived for ideal conditions, symmetrical crack geometry, Newtonian fluids in laminar flow, etc. In real cracks, conditions may not be exactly as assumed. For instance, there might be a quantity of sand in the crack which would interfere with fluid flow, increase pressure drop in the fracture, and lead to a wider crack than predicted. However, Equation 1 is a valuable, conservative guide for design purposes.



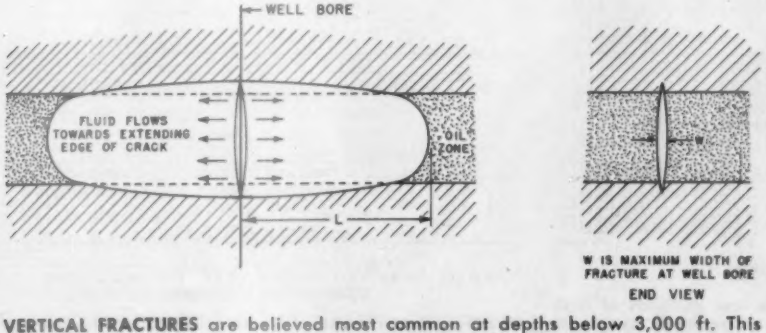
HORIZONTAL FRACTURES are believed to occur most frequently in shallow wells, or where the sand face has been notched. Fig. 5.

$$W = 0.35\,(Q\mu L/E)^{1/4} \qquad (1)$$

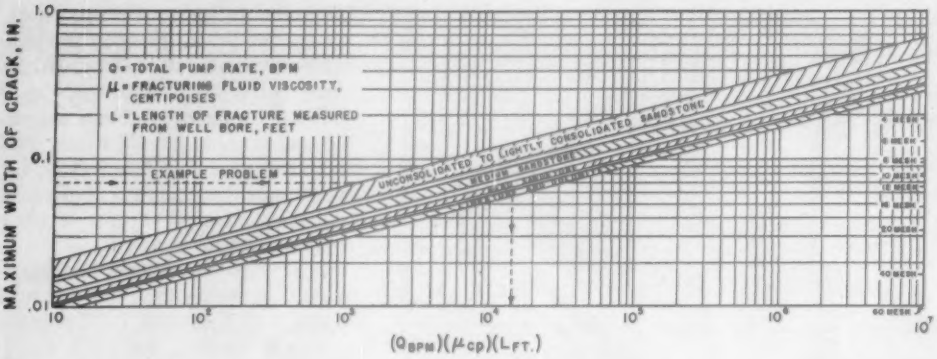
Where:

- W = maximum crack width at well bore, in.
- Q = total injection rate, bbl. per minute
- μ = effective viscosity of fluid in the fracture, cp.
- E = modulus of elasticity of formation rock, psi.
- L = length of fracture from the well bore, ft.

This equation shows that the width of a fracture can be increased by pumping at a faster rate, by using a more viscous fluid, or by increas-



VERTICAL FRACTURES are believed most common at depths below 3,000 ft. This sketch of a restricted fracture is not to scale. Fig. 4.



FRACTURE WIDTHS in restricted vertical fractures vary according to the type of reservoir rock. Fig. 6.

ing the length of the fracture (i.e., by pumping in a larger volume). This equation also predicts that cracks will be wider in formations that have a low modulus of elasticity (soft, porous sandstones) than in formations with high moduli of elasticity (hard sandstones and limestones).

From the literature,[12 13 14] we have selected ranges of Young's moduli for various types of rock. By using these in Equation 1 we have prepared a convenient graph, Fig. 6.

If the crack is horizontal, Fig. 5, Equation 2 can be used to estimate fracture width. Again, this equation should be considered a guide to design.

$$W = 0.22\,(Q\mu R/E)^{1/4} \qquad (2)$$

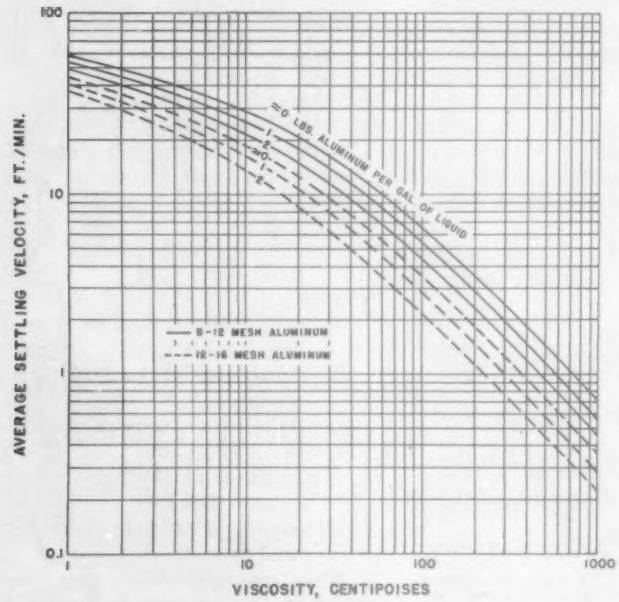
Where:

R = radius of fracture, ft.

Equations 1 and 2 show that Fig. 6 can be adapted to horizontal cracks also. The radius of the horizontal fracture should be used in place of the fracture length of the vertical fracture. This predicted width should then be multiplied by 0.22/0.35 in order to agree with Equation 2.

Because pump rate is frequently limited and long fractures can be obtained only by excessive volumes of fluid, Equations 1 and 2 show that the most practical way to get a relatively wide fracture is to inject viscous liquid into the fracture ahead of the pellets.

Suspension of pellets. Average settling rates of aluminum pellets in viscous fluids is shown in Fig. 7.

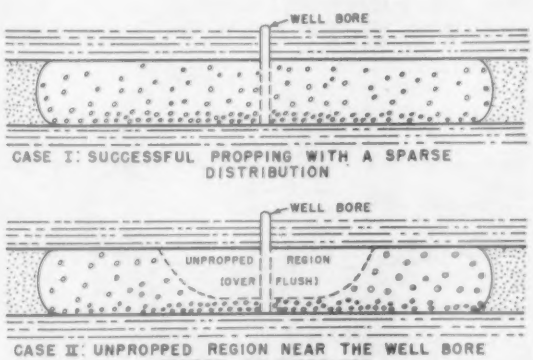


SETTLING VELOCITY of aluminum pellets is low in fluids of high viscosity (sp. gr. = 1). Data shown here have been averaged. Fig. 7.

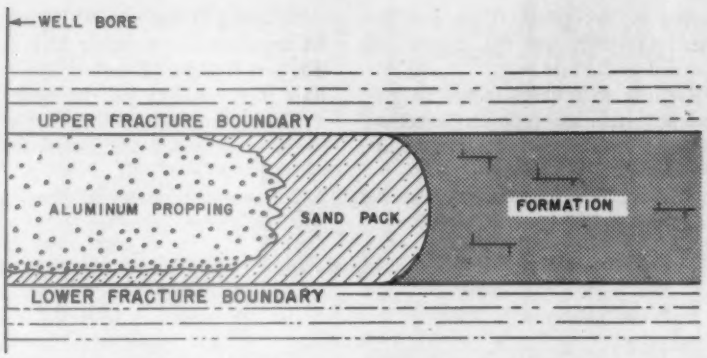
In a previous paper[15] we have discussed how particles can settle into a full pack at the bottom of a vertical fracture. Other papers[16 17] have shown that particles also settle quickly in horizontal fractures. Fluid and particles injected later in the treatment flow through a few channels in this pack toward the extending edge of the fracture. But for best results, the pellets must be in sparse distribution within the fracture. (This also leads to savings.) **Hence, it is important to suspend the particles in a thick carrying fluid regardless of fracture orientation.**

For suspending the pellets, we have used gelled oil (with the concentration of gelling agent two to three times that ordinarily used in sand treatments) and thick water-in-oil emulsions. These fluids would completely suspend the particles in static fluid. Others have reported satisfactory results with gelled water.

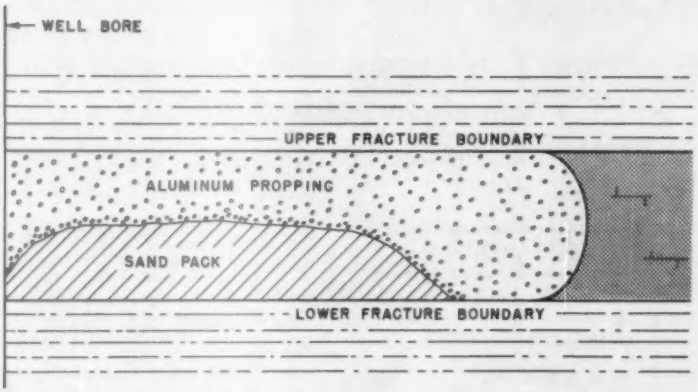
Overflush. An overflush is particularly undesirable when propping with a sparse distribution. Any overflush will substantially reduce the conductivity near the well bore, and this will result in poorer results from


WELL BORE
CASE I: SUCCESSFUL PROPPING WITH A SPARSE DISTRIBUTION
WELL BORE
UNPROPPED REGION (OVER FLUSH)
CASE II: UNPROPPED REGION NEAR THE WELL BORE CAUSED BY OVERFLUSH

OVERFLUSH can cause a fracture job to be a failure if a portion of the fracture is unpropped. Fig. 8.



SAND INJECTION ahead of the aluminum pellets has been found advantageous. Among other things, it reduces the cost of the job. Fig. 9.



MARGIN OF SAFETY in a vertical fracture is created by letting sand settle, followed by the injection of aluminum pellets. Fig. 10.

a fracture job. Fig. 8 shows an unpropped region resulting from overflush. (A similar sketch could be drawn for a horizontal fracture.) During field use of aluminum particles, we have often used an **underflush** of a few barrels to reduce the chance of an accidental overflush.

Using aluminum in conjection with sand. We have sometimes used sand **ahead** of aluminum. If properly designed, this treatment can offer one or both of these advantages:

1. Well stimulation can sometimes be achieved at lower cost.

2. In other cases, this combination can offer a margin of safety. If the aluminum particles do not enter the fracture, if the particles sink into the formation farther than expected, or if there is an inadvertent overflush, then the job will be at least as good as a conventional fracturing process.

Let's use sand ahead of aluminum to reduce the cost of the treatment. After the spearhead of leakoff-control fluid has been injected, sand is introduced in a thick carrying fluid followed by suspended aluminum. It is anticipated that the sand will be carried to the leading edge of the fracture and will be concentrated into a full pack because of fluid leakoff. The aluminum, on the other hand, will be suspended in a sparse distribution and will extend from the well bore into the region propped by sand, Fig. 9.

Another way to use sand offers a margin of safety if the fracture is vertical. A spearhead of leakoff control fluid is injected first. Sand is admitted in the latter part of the spearhead. The conditions are selected such that the sand will settle in a vertical fracture to form a solid pack (i.e., the carrying fluid is thin).[15] Following the sand injection, a spearhead of thick fluid is injected to assure a wide crack for the pellets. Finally, the pellets are injected in a good carrying fluid, Fig. 10. Precautions are taken not to overflush.

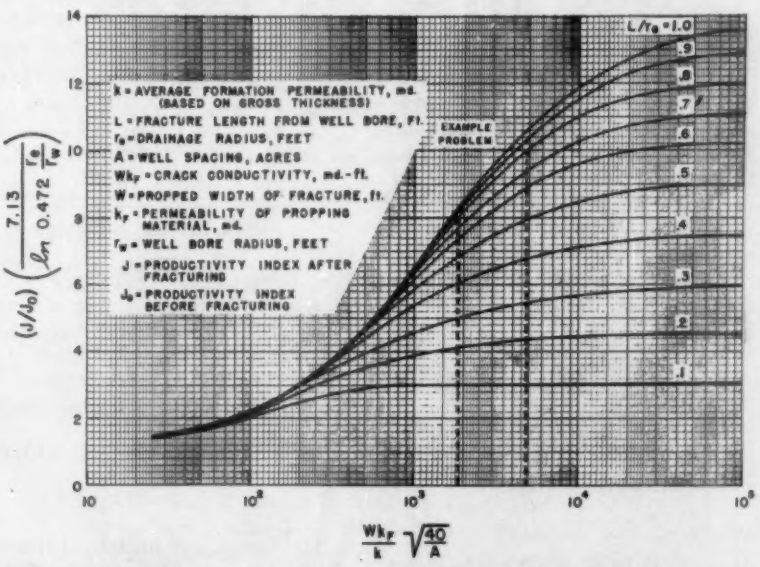
Designing the Treatment

Now let's design a fracture treatment, given these well conditions:

h = height of formation = 30 ft.
k = formation permeability = 12 md.
Z = depth = 5,110-5,140 ft.
A = drainage area = 40 acres
r_w = well-bore radius = 0.25 ft.

The formation is hard sandstone bounded by shale.

It is known that the fracturing pressures in this field are about 0.7 psi. per ft. of depth, indicating a vertically oriented fracture.



EXPECTED INCREASE in productivity from a restricted vertical fracture is shown here as a function of fracture length and well-bore radius. Fig. 11.

Fig. 11 is equivalent to a figure presented recently by McGuire and Sikora.[2] It shows the results that may be expected from a restricted vertical fracture. Similar curves can be found in the literature for horizontal fractures.[1,8,5]

An eight to tenfold increase in well productivity (i.e., J/J_o 8 to 10) is desired. Let us design the treatment with a reasonable fracture length, say 80% of the drainage radius (L = 530 ft.).

The ordinate for Fig. 11 is found to be:

$$\frac{J}{J_o} \times \frac{7.13}{\ln 0.472\, r_e/r_w} = 8 \text{ to } 10 \quad (3)$$

Also

$$\frac{L}{R_e} = \frac{\text{fracture length}}{\text{drainage radius}} = 0.8 \quad (4)$$

Hence, from Fig. 11 (see dashed lines) we see that

$$(Wk_f/k)\,(40/A)^{1/2} \text{ must be from } 2 \times 10^3 \text{ to } 4 \times 10^3 \quad (5)$$

Thus, Wk_f must be

$$Wk_f = \frac{(Wk_f/k)\,(40/A)^{1/2}}{(1/k)\,(40/A)^{1/2}} = \frac{2 \text{ to } 4 \times 10^3}{(1/12)\,(40/40)^{1/2}} = (2.4 \text{ to } 4.8) \times 10^4 \text{ md.-ft.} \quad (6)$$

Fig. 2 shows that this conductivity can be obtained in hard sandstone at the bottom-hole stress of 3,600 psi. (0.7 psi. per ft. × 5,140 ft.) with 1½ lb. per gal. of 12-16 mesh aluminum. (We have arbitrarily selected 12-16 mesh for this example.)

Leakoff properties of the fluid are obtained from the service company as follows:

B = spurt = 10 cc. per 22.8 sq. cm.
C = fluid leakoff coefficient = 0.3×10^{-3} ft./min.
μ = viscosity = 1 cp.

Where:

B and C are measures of the rate at which fluid is lost into the formation at any point. They are defined explicitly in the paper by Howard and Fast.

Assume that calculations or experience indicate that an injection rate of 5 bbl. per minute can be attained in this well. Fig. 6 shows that the crack width during injection of the spearhead is about 0.05 in. Now we determine:

$$(W + B/29)\,(\text{area}) = (W + B/29)\,(2 \text{ fracture length from well bore}) \times (\text{fracture height}) = (0.05 + 10/29)\,(2)\,(530 \text{ ft.})\,(30) = 1.25 \times 10^4 \quad (7)$$

and,

$$\frac{C}{(W + B/29)\,(Q)^{1/2}} = \frac{0.3 \times 10^{-3}}{(0.05 + 10/29)\,(5)^{1/2}} = 3.4 \times 10^{-4} \quad (8)$$

From Fig. 3 (see dashed line), the size of spearhead required is then 9,000 gal.

The volume of neat, viscous fluid required to open the crack before pellets are injected is found from Fig. 6. Suppose the effective viscosity of the carrying fluid is about 20 cp. Maximum width desired at the well bore is about 0.07 in. (i.e., larger than 12-mesh particles). Fig. 6 shows (see dashed line) the $Q\mu L$ must be about 1.5×10^4 Then,

$$L = Q\mu L/Q\mu = \frac{1.5 \times 10^4}{(5 \text{ bbl. per min.})\,(20 \text{ cp.})} = 150 \text{ ft.} \quad (9)$$

Hence, the volume of neat viscous fluid required (assuming no loss from leakoff) is

$$\text{Volume neat gel} = (2 \text{ fracture length})\,(\text{fracture height})\,(\text{fracture width}) = (2)\,(150)\,(30)\,(0.07/12)\,(7.48 \text{ gal. per cu. ft.}) = 400 \text{ gal.} \quad (10)$$

The factor 2 is included because the fracture extends both ways from the well bore.

A safety factor should be included to allow for possible leakoff or dilution by the preceding fluid, so let's inject 1,000 gal. of neat gel.

The volume of the fracture when it closes to touch the aluminum is:

$$V = (2 \text{ fracture length})\,(\text{fracture height})\,(\text{maximum diameter of propping particles}) = 2\,(530)\,(30)\,(0.066/12)\,(7.48 \text{ gal./cu. ft.}) = 1{,}310 \text{ gal.} \quad (11)$$

The total weight of aluminum required is then

$$\text{Weight} = (1.5 \text{ lb. per gal.}) \times (1{,}310 \text{ gal.}) = 1{,}965 \text{ lb.} \quad (12)$$

In summary, the treatment consists of:

1. 9,000 gal. of leakoff-control spearhead;
2. 1,000 gal. of neat gel to widen the crack;
3. 2,000 lb. of aluminum in 1,330 gal. of gel (i.e., 1½ lb. per gal.); and
4. with an **underflush** of 1 or 2 bbl.

Nomenclature

A = well spacing, acres
B = down-hole spurt loss, cc. per 22.8 sq. cm.
C = over-all fluid leakoff coefficient, ft./min.
E = modulus of elasticity of formation rock, psi.
h = height of formation, ft.
J = productivity index after fracturing
J_o = productivity index before fracturing
k = average formation permeability (based on gross thickness), md.
L = length of vertical fracture

measured from the well bore, ft.

Q = total pump rate, bbl. per min.

r_e = drainage radius, ft.

r_w = well-bore radius, ft.

R = radius of horizontal fracture, ft.

W = maximum crack width at the well bore, in.

W_a = average crack width, in.

Wk_f = crack conductivity, md.-ft.

Z = depth of pay zone, ft.

u = effective viscosity of fluid flowing in the fracture, cp.

ln = natural logarithm

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Nelson Refinery Cost Indexes

Published in the first issue each month in the Technology-Operation Section.

Compiled by W. L. Nelson, technical editor and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

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Refinery Construction Cost Index (1946 Basis)

Explained on Page 101 of the issune of August 5, 1957

	1950	1954	1957	1958	1959	1960	Feb. 1961
Pumps, compressors, etc.	138.2	166.5	206.7	214.7	226.5	228.3	228.6
Electrical machinery	134.9	160.0	188.9	192.7	195.8	195.2	193.1
Internal-comb. engines	126.0	150.5	173.9	178.3	178.5	180.7	181.2
Instruments	127.8	154.6	187.4	194.9	201.0	202.5	207.5
Heat exchangers	140.0	171.7	203.6	181.2	178.9	194.0	186.8
Misc. equip. average	*126.2	160.7	192.1	192.4	196.1	200.0	199.6
Materials component	149.5	174.6	201.9	204.2	207.8	207.6	207.6
Labor component	144.0	183.3	208.6	220.4	231.6	241.9	†245.5
Nelson construction index	146.2	179.8	205.9	213.9	222.1	228.2	230.3

Refinery Operating Cost Indexes (1956 Basis)

Explained on Page 171 of the issue of June 1, 1959

	1946	1952	1954	1958	1959	1960	Jan. 1961
Fuel cost	49.6	81.0	86.5	102.1	103.5	109.9	113.4
Labor cost	73.1	88.7	90.9	105.0	102.3	100.3	99.2
Wages	52.4	81.5	88.7	105.4	111.5	113.0	119.8
Productivity	68.3	90.2	97.1	100.3	109.0	112.9	120.7
Investment, maint., etc.	51.2	83.6	92.0	109.5	113.7	116.9	118.0
Chemicals cost	37.0	72.1	85.7	104.4	107.8	114.3	104.0
Operating cost indexes:							
Refinery	58.5	80.5	88.7	105.8	106.8	108.8	107.7
Process units‡	62.9	82.2	88.4	105.8	106.0	107.2	107.6

*Used in computing the Nelson Index until April 1952. †Converting Labor Component to 60% skilled labor rather than 50:50. Transition will be complete by May 1961. ‡Add separate index for chemicals, if any are used.

NEXT WEEK

Big things are happening offshore

THE JOURNAL'S July 10 special report on significant offshore developments will be interesting reading for drillers and producers everywhere. Watch for these stimulating articles next week:

- √ Platform "Hilda" Shows Versatility Off California.
- √ World-Wide Offshore Drillers Bullish.
- √ What's To Be Gained from the Exciting Mohole Project.
- √ How Multirig Platforms Perform Off Gulf Coast.
- √ An Industry Leader Tells What's Needed Offshore.
- √ Spliced Concrete Piles Fill Offshore Construction Gap.

Processing notes

Oil industry moves further into aromatics

FROM a one-time exclusive-supplier position, the coal-chemicals industry has slipped to a poor second to petroleum in supplying aromatics.

Because output of these by-product chemicals is tied directly to steel output, coke-oven operators can do little toward meeting increased demand. But they can take steps—and no doubt will—toward holding the share of the market they are capable of supplying.

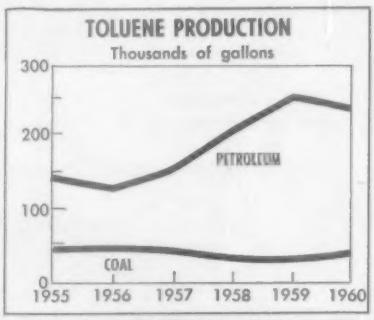
During 1960 petroleum benzene accounted for some 300 million gallons of the 450 million produced. Petroleum-based toluene accounted for almost 90% of the 280-million-gallon output, and more than 95% of the 270 gallons of mixed xylenes.

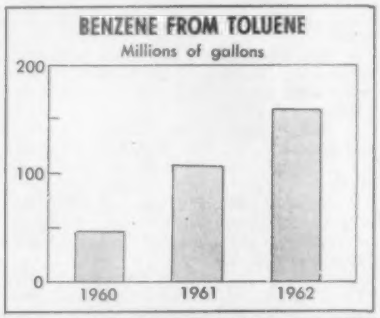
Only in the naphthalene field do coke-oven products predominate. All of last year's 502-million-pound output was coal derived. Now, however, a petro-naphthalene plant with a 75-million-pound capacity is in operation and plants with 375 million pounds annual capacity are under construction or planned.

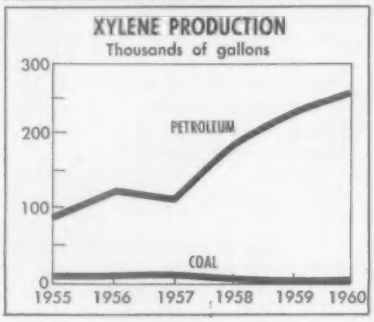
The many BTX units under construction and planned indicate that capacity for petroleum-derived benzene will total about 750 million gallons by late next year. Of this new capacity, more than 150 million gal. will come from hydrodealkylating toluene.

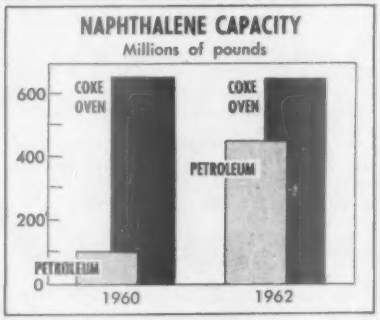
Capacity for coal-derived benzene now is about 210 million gallons annually. Assuming this will remain constant, total benzene capacity will reach 970 million gallons in 1962. As annual consumption is not expected to reach 800 million gallons until 1965, it is obvious there will be excess capacity.

Coke-oven and coal-tar capacity for naphthalene is about 650 million pounds annually. Completion of the additional 365 million pounds of petro-naphthalene capacity will



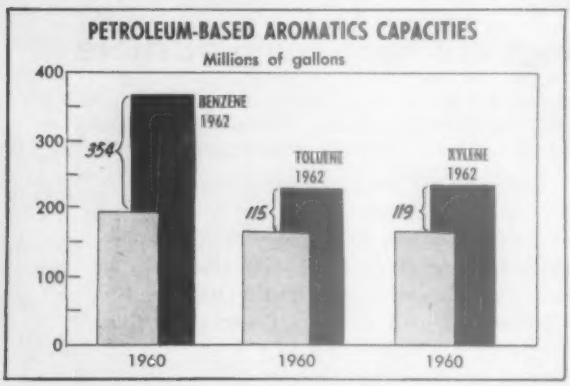


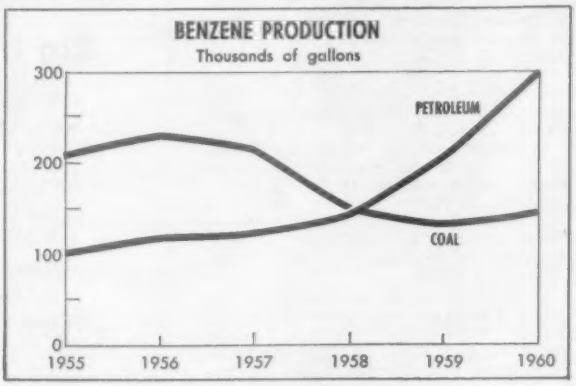




TOLUENE AND XYLENE production from petroleum has outstripped that from coal since 1955, and the gap is widening. Benzene from toluene amounted to 50 million gallons in 1960; projected conversion in 1962 is 150 million gallons. Petroleum naphthalene is expected to press coke-oven naphthalene closely in 1962. (Figures at right.)

PETROLEUM-BASED aromatics capacities are expected to be up sharply in 1962, compared with 1960 capacities. Benzene production from petroleum passed that from coal in 1958, and gap has steadily widened since. (Figures below.)





bring the total to about 1,100 million pounds. This will exceed domestic and export requirements for the next several years.

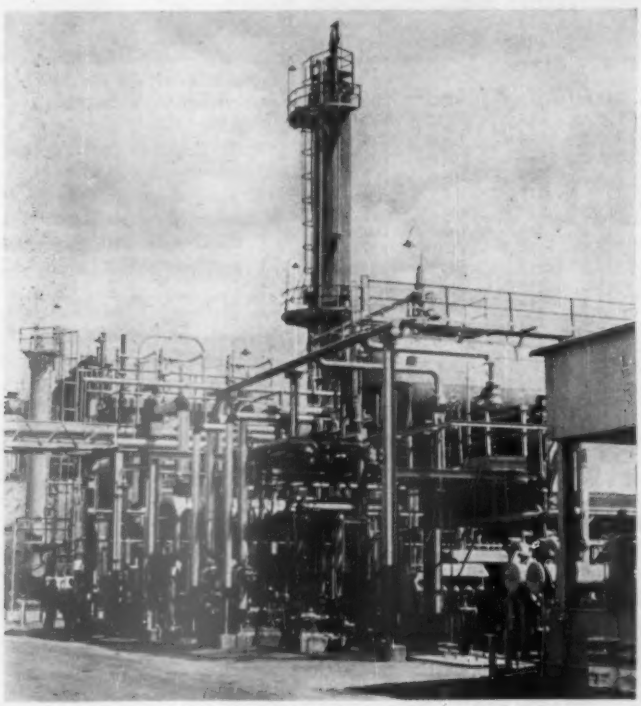
How cokers can compete. For coal aromatics to retain their markets, coke-oven operators will have to improve the quality of their products, said Martin Faye, of U. S. Industrial Chemicals Co., in a recent talk at the American Coke and Coal Chemicals Institute meeting at Rye, N. Y. An alternative, and possibly joint countermove, would be to resort to price cutting.

Since their aromatics are by-products, coke-oven operators probably are in a better position to shave prices than refiners. This would be particularly true for benzene and naphthalene resulting from dealkylation.

Coal-based naphthalene of about 95% purity now receives about 6 cents per pound, about the same as the 99%-plus purity product of petrochemical plants. If price cutting becomes necessary, coal-tar naphthalene producers reportedly could cut their price to 3.5 or 4 cents per pound.

Most coal-aromatics producers have made little effort to remove impurities (principally 250 - 1,000 p.p.m. of thiophene) from their BTX and naphthalene. Under the more competitive conditions they now face, it can be expected that more will take steps to improve product quality.

Two simple metallic sodium processes have been developed that can lower the thiophene content of coke-oven aromatics to 1 p.p.m. or lower for less than 1 cent per gallon.



Phillips Butamer unit on stream

NOW ON STREAM at Phillips' Borger, Tex., refinery is this new butane isomerization unit. Phillips Petroleum Co. is producing approximately 4,500 bbl. per stream day of isobutane with a Butamer unit. Process design of the unit was by Universal Oil Products Co., Des Plaines, Ill. Mechanical design and construction was by Phillips Petroleum Co. Isobutane from the unit is used in the production of alkylate. The process uses a high-activity catalyst to permit operations at the low temperatures especially desirable for butane isomerization.

Car engines only half as efficient as theoretically possible

AUTOMOBILE ENGINES twice as efficient as those in today's cars are theoretically possible. This was revealed by Murray H. Edson, of Esso Research & Engineering Co., before an SAE meeting in St. Louis recently.

Edson has created a mathematical model of an ideal engine, and with the aid of an electronic computer has studied what might be expected of this engine if its compression ratio were raised from present levels to 300 to 1.

"We stopped at 300 to 1 compression ratio only as a matter of convenience. Actually, there appears to be no theoretical limit to the increase in efficiency of internal-combustion engines," Edson said.

Practice Must Overtake Theory

Edson stressed that although engines of greatly improved efficiency are mathematically possible, it will be a long time before they can actually be built. "Practice will have to catch up with theory. New fuels, new materials, and new engineering know-how to make these engines will have to be developed," he said.

"We began the study of this ideal mathematical engine because we wanted to know if there are theoretical limits to thermal efficiency—the measure of an engine's ability to convert heat into work," said Edson. "There would be no incentive to develop better fuels if thermal-efficiency limitations would knock them out after a certain compression ratio is reached," he explained.

The extra-efficient new engines may be completely different from current auto power plants when they are finally created. Special fuel-injection and timing techniques may be needed for proper combustion control. New materials of construction will be needed to withstand the pressures and temperatures developed at really high compression ratios.

The engines may have different shapes, due to valving problems and to the need for blocks of greater strength. This may necessitate the complete redesign of the engine compartment of the cars which will use the new power plants.

Tabulated values of Nelson refinery operating cost indexes

	Fuel	Wages	Productivity	Labor	Investment	Chemicals	Nelson Refinery	Nelson Process† units
1926*	61.0	26.1	84.5	31.0	36.8	9.6	40.1	46.4
1930*	41.2	26.2	88.5	29.5	36.0	19.6	35.5	38.7
1940*	33.3	33.5	95.0	35.0	39.7	32.8	36.5	37.2
1946‡	49.6	50.0	68.3	73.1	51.2	37.0	58.5	62.9
1950*	70.3	69.5	85.2	81.5	74.8	59.3	72.4	75.1
1956*	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1957	115.1	104.1	98.1	106.1	105.4	102.2	106.7	107.7
1958	102.1	105.4	100.3	105.0	109.5	104.4	105.8	105.8
1959								
January	103.8	108.5	112.3	96.7	112.0	102.7	103.2	102.7
February	105.7	109.7	113.0	97.1	112.3	101.9	103.7	103.4
March	105.8	111.8	109.6	102.0	112.1	101.0	105.3	105.6
April	104.8	113.0	105.6	107.0	112.0	104.2	107.7	108.1
May	105.1	112.2	104.9	107.0	112.6	104.9	108.1	108.3
June	103.1	111.0	107.0	103.8	113.0	104.8	106.6	106.4
July	100.5	112.1	106.3	105.4	114.1	106.1	107.4	107.5
August	104.1	109.1	112.8	96.8	114.9	107.7	105.0	103.7
September	102.4	114.7	108.8	105.4	115.1	112.3	108.9	107.7
October	102.6	110.5	105.7	104.5	115.3	113.0	108.7	107.4
November	103.7	114.1	110.0	103.8	115.5	116.3	109.2	107.3
December	105.4	110.4	113.1	97.6	115.5	118.3	107.3	104.5
Year 1959	103.5	111.5	109.0	102.3	113.7	107.8	106.8	106.0
1960								
January	105.4	111.1	114.2	97.3	115.8	114.2	106.6	104.5
February	105.8	111.3	111.6	99.8	115.7	113.0	107.4	105.8
March	106.0	110.9	109.2	101.6	115.6	114.0	108.3	106.7
April	107.1	114.3	109.9	103.9	116.0	114.5	109.6	108.2
May	107.2	113.6	110.0	103.3	116.2	115.5	109.6	107.9
June	108.9	113.8	111.2	102.2	117.1	115.0	109.7	108.0
July	111.4	114.9	116.5	98.6	117.5	113.3	108.4	106.8
August	114.0	113.4	115.2	98.5	117.8	113.3	108.8	107.4
September	113.8	115.2	114.0	101.0	117.9	114.3	110.0	109.6
October	113.2	112.4	112.5	100.0	117.7	115.2	109.6	108.0
November	112.9	113.1	113.2	100.0	117.4	115.5	110.0	108.5
December	112.9	113.1	115.3	98.0	117.4	114.7	108.5	106.8
Year 1960	109.9	113.0	112.9	100.3	116.9	114.3	108.8	107.2
1961								
January	113.4	119.8	120.7	99.2	118.0	104.0	107.7	107.6
February	114.2	116.9	122.0	95.8	117.9	104.4	106.5	106.3

*For years back to 1926, see Process Costimating No. 2, The Oil and Gas Journal, March 3, 1958, p. 167. †Chemical costs (if any) must be handled separately. ‡Base year for Nelson Refinery Construction Cost Index.

MONTHLY values of the Nelson Operating Cost Indexes for refineries and for process units have been published since January 1959. Yearly averages for the years back to 1926 were published in Process Costimating No. 2, The Oil and Gas Journal, March 3, 1958, p. 167.

Monthly variations are great because of constantly changing fuel prices, wage rates, and the productivity of labor. Productivity is related to refinery crude runs and this, too, constantly changes. In addition, the cost of chemicals is constantly being revised as data on catalyst (or chemical) consumption and improvements in processing become available. Thus the cost of chemicals tends to lag actual practice by 6 months to 1 year. As examples, since 1959:

1. Revised gasoline additive unit consumption upward during 1959.
2. Constantly decreased cost of platinum catalyst because of increased regeneration and reworking of catalyst (1958-59).
3. Revised unit consumption of lube additives upward (1959-61).
4. Decreased cracking catalyst unit consumption (1960-61).
5. Decreased hydrogen treating catalyst cost and unit consumption (1960-61).
6. Decreasing sulfuric acid unit consumption in alkylation (1961-62).

All of these somewhat necessary variations tend to make the monthly values less significant than the yearly averages, but even the yearly averages are greatly affected by the price of fuel.

Itemized Cost Indexes

	1950	1954	1958	1959	1960	Feb. 1961	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Tech. issues
Operating costs (based on 1956 as 100.0):								
Power, electrical, industrial	97.3	98.5	102.8	103.2	104.8	105.2	Code 541-03	No. 13, May 19, 1958
Fuel, refinery	70.3	86.5	102.1	103.5	109.9	114.2		No. 4, Mar. 17, 1958
Gulf cargoes	78.0	85.9	102.9	93.5	101.8	107.5		No. 4, Mar. 17, 1958
N. Y. barges	76.9	82.6	93.0	85.9	91.2	94.9		No. 4, Mar. 17, 1958
S. Pedro bunkers	65.8	84.3	114.6	99.5	98.2	97.2		No. 4, Mar. 17, 1958
Oklahoma, northern shipments	77.7	62.0	66.3	78.8	83.7	88.7		No. 4, Mar. 17, 1958
Natural gas at wellhead	60.2	93.5	118.3	130.3	142.4	148.4	Code 531-01	No. 4, Mar. 17, 1958
Industrial chemicals	83.3	96.9	101.8	102.1	102.1	101.6	Code 61	No. 58, Oct. 12, 1959
Acid, phosphoric	86.7	96.6	103.4	103.4	103.4	103.4	Code 611-07	No. 58, Oct. 12, 1959
Acid, sulfuric	80.8	100.0	100.0	100.0	100.0	100.0	Code 611-09	No. 58, Oct. 12, 1959
Ammonia	104.8	103.0	103.8	105.1	108.1	111.3	Code 611-13	No. 58, Oct. 12, 1959
Lime	64.6	92.0	104.4	106.1	108.5	109.2	Code 611-29	No. 58, Oct. 12, 1959
Sodium carbonate	75.5	92.9	104.3	104.3	104.3	104.3	Code 611-65	No. 58, Oct. 12, 1959
Sodium hydroxide	76.3	90.9	112.6	115.7	115.7	115.7	Code 611-69	No. 58, Oct. 12, 1959
Sodium phosphate	87.5	95.5	104.6	104.6	104.0	101.2	Code 611-71	No. 58, Oct. 12, 1959
Furfural	79.0	100.0	100.0	100.0	98.6	95.8	Code 612-63	No. 58, Oct. 12, 1959
MEK, drums	80.0	94.5	106.9	103.3	103.3	103.3	Ch. & E. News	No. 58, Oct. 12, 1959

(Continued on next page.)

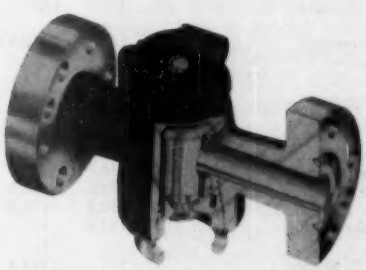
. . . *in terms of torque,*
WHICH VALVE TURNS EASIER?

If you picked the one on the *left,* you have a winner. It's no secret that it is easier to turn something being held as opposed to something being *gripped* . . . but the trick was to apply this low torque principle to a plug valve design.

This is exactly what Halliburton did. The Halliburton LO-TORQ PLUG VALVE is so designed that when the valve is closed, a pressure balance exists on both sides of the plug. Also, the plug is cylindrical — not tapered which often causes cocking and jamming under pressure. But there is more to the story:

THE LO-TORQ VALVE SEALS HIGH PRESSURES 3 WAYS

The primary O-ring seal is between the body and O. D. of the insert, plus stem packing at the top and bottom of the pressure balanced plug. A metal-to-metal seal exists between the plug and I. D. of the inserts for fluid service. Valves for gas service have a seal of bonded Teflon ring on the inner surface of the inserts. Valves for chemical service have the inner surface of the inserts completely lined with Teflon filler.



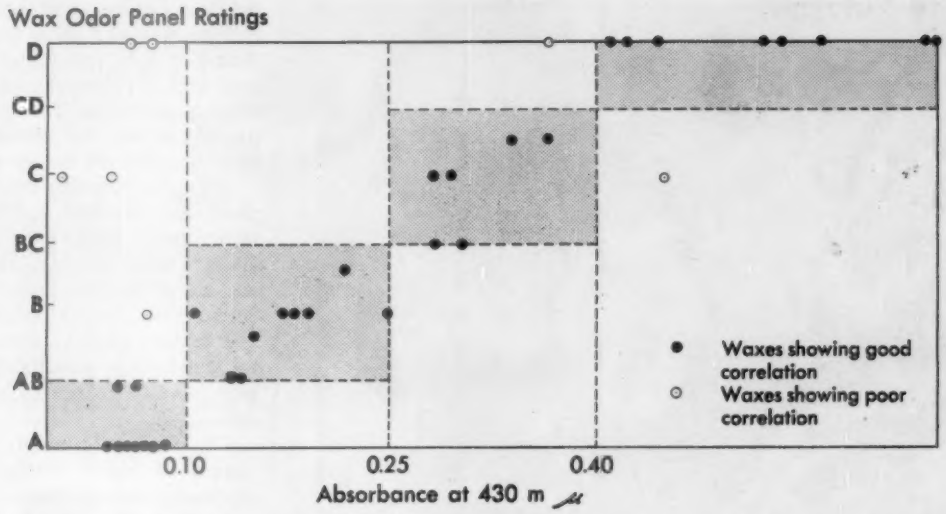
FOR 1" TO 3" LINES — 1,000 to 15,000 PSI WORKING PRESSURES, (depending on valve size) investigate the Halliburton Lo-Torq Plug Valve. Your Halliburton man has the list of features (long!) . . . the prices (low!) . . . and the valves (immediately!) with flanged ends, threaded ends, and multiple valves for Christmas trees. See him soon.

Halliburton
COMPANY · DUNCAN, OKLAHOMA

Itemized Cost Indexes (continued)

	1950	1954	1958	1959	1960	Feb. 1961	References*	Index for earlier years (The Oil and Gas Journal) in Costimating and Questions on Tech. issues
Platinum	101.5	82.6	63.7	71.8	80.0	80.4	Code 1022-30	
Phenol	81.3	90.4	102.7	96.8	95.2	101.6	Code 612-83	No. 58, Oct. 12, 1959
TEL	94.1	102.8	99.9	100.7	97.7	97.7	Supplier	No. 58, Oct. 12, 1959
Operating labor (wages)	72.0	88.7	105.4	111.5	113.0	116.9	Employ. & Earn.	No. 41, Feb. 16, 1959
Productivity	85.5	97.1	100.3	109.0	112.9	122.0	Employ. & Earn.	No. 41, Feb. 16, 1959
Construction wages (1946 = 100):								
Skilled construction	140.0	174.6	205.1	214.6	223.5	228.8	Eng. News Record	No. 55, Nov. 3, 1949
Common labor	148.1	192.1	235.7	248.6	261.1	267.7	Eng. News Record	No. 55, Nov. 3, 1949
Refinery construction	144.0	183.3	220.4	231.6	241.9	245.5		No. 61, Dec. 15, 1949
Equipment or material (1946 = 100):								
Arc-welding machinery		158.4	193.2	192.1	199.6	195.6	Code 1176	May 2, 1955†
Boilers, tanks and sheet metal	136.0	147.3	175.1	177.2	181.0	179.5	Code 1072	No. 5, Nov. 18, 1949
Building materials (nonmetallic)	127.0	143.6	161.7	163.5	164.0	164.5	Code 13	No. 61, Dec. 15, 1949
Brick—building	132.5	144.7	162.4	166.4	169.2	169.4	Code 1341	No. 20, Mar. 3, 1949
Brick—fireclay	153.4	193.1	238.7	244.4	244.4	244.7	Code 1342	May 30, 1955†
Castings (foundry products)	152.9	181.1	227.2	231.6	233.3	234.2	Code 1015	No. 46, Sept. 1, 1949
Clay products (structural, etc.)	134.6	159.1	187.0	191.4	193.0	193.4	Code 134	No. 20, Mar. 3, 1949
Concrete ingredients	125.3	142.1	163.2	164.7	167.8	167.1	Code 132	No. 22, Mar. 17, 1949
Concrete products	124.4	138.5	151.0	152.9	154.6	154.2	Code 133	
Electrical machinery	134.9	159.9	192.7	195.8	195.2	193.1	Code 117	May 2, 1955†
Motors and generators	135.0	157.7	186.4	186.4	182.8	180.9	Code 1173	No. 31, May 19, 1949
Switch gear		171.2	218.8	223.5	221.0	221.5	Code 1175	May 2, 1955†
Transformers	131.6	161.9	187.3	188.6	181.8	168.4	Code 1174	No. 31, May 19, 1949
Engines (composite)	126.0	150.5	178.3	178.5	180.7	181.2	Code 1154	No. 36, June 23, 1949
Exchangers	140.0	171.7	181.2	179.3	194.0	186.8	Manufacturer	No. 2, Oct. 28, 1948
Copper base		190.7	168.8	169.6	184.9	178.8	Manufacturer	
Steel		156.8	190.0	186.4	201.2	193.0	Manufacturer	
Fans and blowers	162.9	192.6	241.7	244.4	244.0	243.2	Code 1147	Feb. 17, 1949†
Hand tools	143.2	173.8	224.7	230.4	234.5	237.4	Code 1042	June 27, 1955†
Instruments (composite)	127.8	154.6	194.9	201.0	202.5	207.5	Manufacturer	No. 34, June 9, 1949
Pressure recorder (pneu.), PR	137.9	168.0	204.0	204.0	206.3	208.3	Manufacturer	No. 34, June 9, 1949
Pressure recorder (elect.), PR	137.0	162.8	229.5	246.6	243.0	245.7	Manufacturer	No. 34, June 9, 1949
Pressure recorder cont. (pneu.), PRC	134.0	163.5	198.8	198.7	201.7	203.0	Manufacturer	No. 34, June 9, 1949
Pressure cont. (elect.), PRC	135.0	160.2	225.7	242.8	239.2	241.9	Manufacturer	No. 34, June 9, 1949
Pressure recorder cont. (stand.), PRC	135.6	166.3	200.0	200.0	204.7	207.1	Manufacturer	No. 34, June 9, 1949
Pressure gage only, PI	101.2	108.6	119.2	119.2	119.2	119.2	Manufacturer	No. 34, June 9, 1949
Flowmeter (mech.), FR	114.0	161.6	209.9	219.1	221.0	227.0	Manufacturer	No. 34, June 9, 1949
Flowmeter (pneu.), FR	113.8	161.4	209.6	218.8	220.7	226.7	Manufacturer	No. 34, June 9, 1949
Flowmeter (elect.), FR	136.8	162.3	228.5	245.6	242.0	244.9	Manufacturer	No. 34, June 9, 1949
Flow control (air), FRC	138.5	179.6	216.3	223.5	228.7	231.3	Manufacturer	No. 34, June 9, 1949
Flow control (remote), FRC	135.5	146.5	176.4	178.1	178.5	180.3	Manufacturer	No. 34, June 9, 1949
Flow control (pneu.), FRC	131.1	160.3	194.3	198.0	200.8	202.7	Manufacturer	No. 34, June 9, 1949
Flow control (elect.), FRC	134.0	159.1	224.1	241.1	237.4	240.1	Manufacturer	No. 34, June 9, 1949
Temp. recorder (pneu.), TR	128.3	157.3	188.1	188.1	190.6	192.6	Manufacturer	No. 34, June 9, 1949
Temp. recorder (elect.), TR	135.5	160.8	226.4	243.5	239.9	242.6	Manufacturer	No. 34, June 9, 1949
Potentiometer, 6-point, TR	134.0	167.2	240.4	258.9	240.9	240.8	Manufacturer	No. 34, June 9, 1949
Potentiometer (air con.), TRC	134.1	150.5	212.6	231.6	242.4	247.8	Manufacturer	No. 34, June 9, 1949
Thermometer recorder cont., TRC	124.0	152.8	179.7	179.7	183.9	186.0	Manufacturer	No. 34, June 9, 1949
Temp. control (pneu.), TRC	126.2	154.7	184.9	184.9	187.1	189.2	Manufacturer	No. 34, June 9, 1949
Temp. control (elect.), TRC	135.4	160.7	226.2	243.3	239.7	242.4	Manufacturer	No. 34, June 9, 1949
Control valve (pneu.)	133.3	162.0	199.3	199.3	199.3	199.3	Manufacturer	No. 34, June 9, 1949
Control valve (elect.)	133.3	161.9	199.2	199.2	199.2	199.2	Manufacturer	No. 34, June 9, 1949
Insulation (composite)		198.5	188.0	186.8	188.5	188.5	Manufacturer	
Lumber (composite)	193.0	197.8	198.9	214.1	204.8	191.2	Code 81	No. 7, Dec. 2, 1948
Southern Pine	176.9	181.2	184.7	190.9	187.9	177.8	Code 812	No. 7, Dec. 2, 1948
Redwood, all heart	212.0	238.0	204.0	218.5	211.4	184.4	Code 813-31	
Cypress, C select	250.0	253.0	266.5	267.5	267.4	266.9	Code 813-41	
Machinery:								
General purpose	136.7	159.9	199.6	206.0	208.4	207.1	Code 114	Feb. 17, 1949†
Construction	140.1	165.9	209.6	217.0	221.8	224.9	Code 112	
Oil field	135.8	161.9	192.5	192.6	193.0	194.8	Code 1151	Oct. 10, 1955†
Paints—prepared	140.0	159.0	180.9	179.9	181.2	186.3	Code 621	May 16, 1955†
Pipe:								
Sewer	120.7	140.1	170.1	176.2	178.2	177.6	Code 1345	No. 22, Mar. 17, 1949
Black iron	160.0	195.0	264.8	263.8	261.0	258.2	Code 1014-56	No. 42, Aug. 4, 1949
6-in. line	‡156.5	‡182.7	‡252.4	‡251.5	248.9	246.3	Code 1014-58	
Pumps, air compressors, etc.	138.2	166.5	214.7	226.5	228.3	228.6	Code 1141	No. 29, May 5, 1949
Steel (iron and steel)	152.9	179.6	228.2	232.4	229.7	229.7	Code 101	No. 61, Dec. 15, 1949
Steel—finished steel	153.7	187.1	240.6	244.7	244.0	243.7	Code 1014	July 25, 1955†
Plate		187.0	252.7	257.4	254.3	254.3	Code 1014-26	No. 5, Nov. 18, 1949
Structural shapes	162.7	193.4	262.8	268.5	268.3	268.3	Code 1014-31	No. 18, Feb. 17, 1949
Seamless tubes, 2-2¼ in.	149.5	199.4	277.5	285.1	282.7	282.7	Code 1014-61	Sept. 5, 1955†
Valves and fittings	135.8	197.1	242.7	257.6	260.3	249.9	Code 1149 (10 items)	No. 46, Sept. 1, 1949
Nelson Refinery Construction (1946)	146.2	179.8	213.9	222.1	228.2	230.3		No. 61, Dec. 15, 1949
Nelson Refinery Operation (1956)	72.4	88.7	105.8	106.8	108.8	106.5		No. 2, Mar. 3, 1958
Nelson Refinery Process Operation (1956)	75.1	88.4	105.8	106.0	107.2	106.3		No. 2, Mar. 3, 1958

*Code refers to the index code number of the Bureau of Labor Statistics, U. S. Department of Labor, "Wholesale Prices." †Questions on Technology, The Oil and Gas Journal. ‡Revised.



AN 80% CORRELATION was found between colorimetric tests and an odor panel's rating of waxes. Fig. 1.

Carbonyl test detects wax odor

Certain odor-causing compounds in wax make it unsuitable for many applications such as coating paper, fiber board and milk cartons. This study shows that there is a reasonable correlation between colorimetric tests on carbonyl compounds stripped from wax and an odor panel's evaluation of the same wax.

BY M. E. PETERKIN
AND J. W. LOVELAND
Research and Engineering Department
Sun Oil Co.

THE USUAL means of identifying wax odors is by smell. In many companies, for example, it is common to use a panel of experts who smell scrapings of the wax sample.

Since individuals differ in their response to the types and levels of odor, the average result obtained is taken as the odor rating of the wax. Such a rating might be expressed in the following manner: A—no odor; B—no objectionable odor; C—objectionable odor; D—very bad odor. Depending upon experience, two or more odor panels might classify wax odors in different ways.

The purpose of our investigation was to find a suitable test for objectively rating wax odors. We found that a reasonable correlation exists between colorimetric tests on carbonyl compounds stripped from wax and an odor panel's evaluation of the same wax.

Table 1 shows the rating given to four waxes by the panel members. One member calls them all C or D, another all A or B, and another all B. In this same table are given results on the same waxes using our carbonyl test. The test rated the waxes consistently with the panel's average.

The "equivalent odor panel rating" from the carbonyl test was developed after taking 40 different waxes and comparing data (obtained on a spectrophotometer) with the average panel ratings.

Results from these 40 waxes are shown in Fig. 1 where the average wax odor panel's ratings are plotted against the absorbance, at 430 mμ.

Odor Identification

Oxidation is believed to be the most common cause of wax odors. Oxidation reactions undoubtedly lead to the formation of peroxides, aldehydes, ketones, alcohols, and acids.

As a result, wax odor is composed of many individual compounds which must be separated before they can be identified. To effect such a preparation, a partitioner was used having a 10-ft. silicone column and using helium as the carrier gas.

The problem of charging the wax-odor compounds to the chromatograph was solved in the following way: 100 g. of the wax under examination was placed in a flask and heated to 275° F. under an atmosphere of nitrogen. Nitrogen was bubbled through the molten wax and the volatile material collected in a coil of copper tubing immersed in liquid nitrogen.

To eliminate the interference of

TABLE 1—COMPARISON OF ODOR PANEL RATINGS AND CARBONYL TEST

	Wax-odor panel ratings						Chemical carbonyl test	
	Individual ratings							
Sample	(1)	(2)	(3)	(4)	(5)	Average	Abs. at 430 mμ	Equivalent odor panel rating
W	C	A	B	B	B	B	0.060	(A)
X	C	B	B	B	B	B	0.100	(B)
Y	C	B	C	C	B	C	0.280	(C)
Z	D	B	D	C	B	C	0.285	(C)

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water, a U-tube filled with calcium carbide was placed in the effluent stream before the liquid nitrogen cold trap. Calcium carbide converts water to acetylene. This presents no problem on the chromatogram, since it comes off the air peak.

When the stripping run was complete, the trap was sealed and attached to the inlet of the chromatograph. After heating, the sample was swept into the instrument with carrier gas. Various pure aldehydes and ketones up to C_7 were run both to standardize conditions and to help identify unknowns in the wax odor.

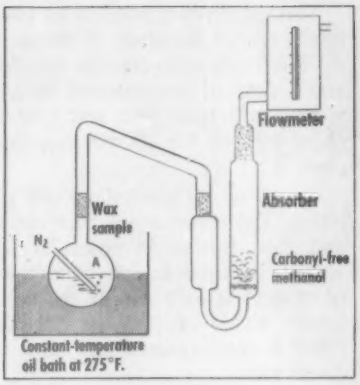
The chromatogram obtained on a sample of highly oxidized D wax shows six discrete peaks after water removal. Identification of these peaks is difficult, since there are many compounds which might come off in this region. None of the readily available aldehydes (acet, propion, isobutyr, and n-butyraldehyde) or ketones (diethyl, methypropyl, and methylamylketone) matched the retention times of the D wax components.

Another run was made on the same wax, and as each major component was eluted from the chromatograph, it was absorbed in a specially purified methyl alcohol solution. The carbonyl test showed that four of the five components collected were either ketones or aldehydes. From the retention times of known aldehydes and ketones, we conclude that the wax-odor components contained seven or fewer carbon atoms in their structure.

Carbonyl Test

Having ascertained that carbonyl components were primarily responsible for odors in highly oxidized wax from our gas chromatographic experience, a variable study was made to determine what conditions would be best for colorimetric determination of these odor materials.

The method of Lappin and Clark (Anal. Chem., Vol. 23, p. 541, 1951) was used. In this method a highly colored complex is formed by reacting 2,4-dinitrophenylhydrazine with the carbonyl. The color formed in basic solution is measured spectrophotometrically. The technique was modified slightly for our problem. The modification required nitrogen stripping of the volatile components from a molten wax sample



STRIPPING APPARATUS is used to charge odor-causing compounds to a spectrophotometer. Fig. 2.

and subsequent absorption in methanol. This is followed by the colorimetric determination. Variables explored which might affect the sensitivity of the test were (1) the wave length for the spectrophotometric determination, (2) the nitrogen stripping time, and (3) the temperature of the wax during stripping.

After studying the effect of these variables, we developed the following test as it is now run.

Apparatus includes the stripping setup shown in Fig. 2, which consists of a constant-temperature oil bath set at 275° F., a 1-1 tapered joint flask fitted with nitrogen bubbling tube, a sintered glass absorber (ASTM absorber D1266-57T), a flowmeter to cover the range from 100 to 1,500 ml. per minute, a connecting arm between flask and absorber, and a spectrophotometer.

Reagents. A solution of 2,4-dinitrophenylhydrazine, specially purified by double recrystallization from methanol, must be freshly prepared every few weeks. A saturated solution in carbonyl-free methanol is used as the working reagent.

... **Reagent-grade methanol** must be specially purified in the following way:

Add 2 g. of 2,4-dinitrophenylhydrazine and 1 ml. concentrated HCl to 1,500 ml. reagent-grade methanol in a 2,000-ml. flask fitted with a water-cooled condenser.

Reflux for 30 minutes, then distill the liquid into a clean receiver. Use the first few 25-ml. portions to rinse the equipment, then retain the next 1,000 ml. in a receiving flask.

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Test the distilled product by placing 5 ml. of distillate, 5 drops of 2,4-dinitrophenylhydrazine solution and 1 drop of concentrated HCl in a clean test tube. Mix and heat to about 60° C. for 10 minutes, then cool.

Add 2 ml. of alcoholic KOH solution. The solution will turn black, and then lighten in color. If the alcohol is yellow in color, the batch of reagent is all right. If the color is any shade of pink or red, the batch is contaminated and must be discarded.

. . . Alcoholic KOH solution is prepared by dissolving 10 g. KOH in 20 ml. of water and diluting to 100 ml. with carbonyl-free methanol.

Sample Testing Procedure

Weigh 100 g. of wax sample, cut into slivers and insert in flask (Fig. 1). Add 25 ml. of carbonyl-free methanol to the absorber. When wax is melted and at temperature (275° F.) turn on nitrogen stream at a rate of 1,000 ml. per minute, as indicated on the flowmeter. Continue stripping operation for 45 minutes.

Remove absorber and transfer contents to a 25-ml. volumetric cylinder. If the volume is less than 17 ml., add fresh carbonyl-free methanol to bring the volume to 17 ml. Add 1 ml. 2,4-dinitrophenylhydrazine solution, stopper, and invert several times to mix. Add 2 drops of concentrated HCl and mix again.

Place the unstoppered cylinder in a hot water bath at 60° to 65° C. for 15 minutes, then remove and cool in a cold water bath for about 5 minutes.

Dilute to 25 ml. with alcoholic KOH solution and invert several times to mix. Ten minutes after mixing, determine the absorbance in a 1-cc. cell at 430 mμ.

More work is required to pin down all the various types of odors that occur in waxes. The present carbonyl test is a step forward, but requires more information, since it does not include all of the various odors in waxes. More sensitive gas chromatographic techniques such as those that employ capillary columns and ionization detectors should yield more fundamental information as to the nature and quantity of odor components in waxes.

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Let glycols help inhibit hydrate formation

By J. L. ARNOLD AND R. L. PEARCE, Dow Chemical Co.

Part 2 of Two Parts

Ethylene vs. diethylene glycol

THE FOLLOWING section compares the use of ethylene glycol and diethylene glycol for low-temperature separation units. For this comparison the following conditions are assumed:

Gas pressure	800 psig.
Gas temperature	85° F.
Chiller temperature	+5° F.
Gas specific gravity	0.75
Total gas handled per day	8 M.M.s.c.f.

Gas is saturated with water vapor.

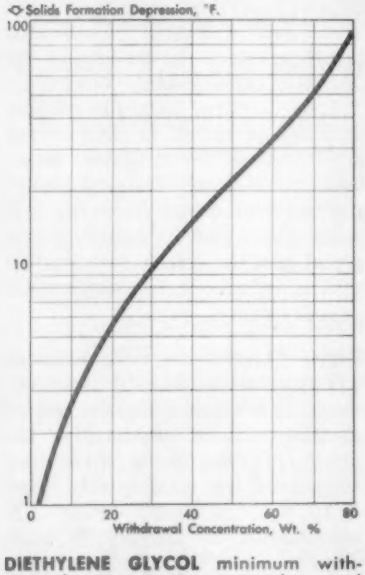
The first step is to determine the hydrate depression point required. This is done by referring to Fig. 3. It is seen that for a gas at 800 psig. and with a specific gravity of 0.75, hydrates will form at any temperature under 64° F. Therefore, a hydrate depression of 59° F. is required for a +5° F. chiller temperature.

The minimum final concentration of 61% for ethylene glycol is obtained from Fig. 5, and of 75% for diethylene glycol from Fig. 7. Minimum concentrations may also be determined by use of the Hammerschmidt equation, as in the preceding section.

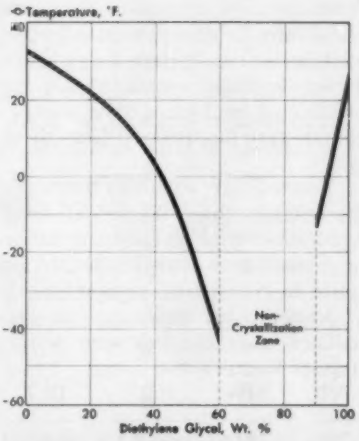
Next, usable concentration limits of the glycols are determined from Figs. 6 and 8. These prove to be 30-98% for ethylene glycol and 40-95% for diethylene glycol.

The best concentrations to prevent excess vaporization loss during regeneration are 75% ethylene glycol and 90% diethylene glycol. The reboiler temperatures necessary to maintain these concentrations can be found in Fig. 9 and 10. For ethylene glycol this temperature is 250° F. and for diethylene glycol it is 271° F.

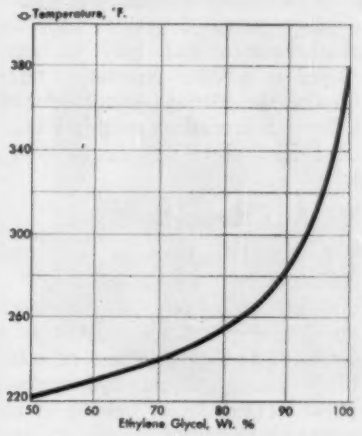
The accompanying table reveals that saturated gas at 85° F. and 800 psig. contains 46.2 lb. of water per M.M.s.c.f. At a chiller temperature of +5° F. the water content for this same quantity of gas is 2.8 lb. Therefore, 43.4 x 8÷24 or 14.5 lb. of water to be removed per hour.

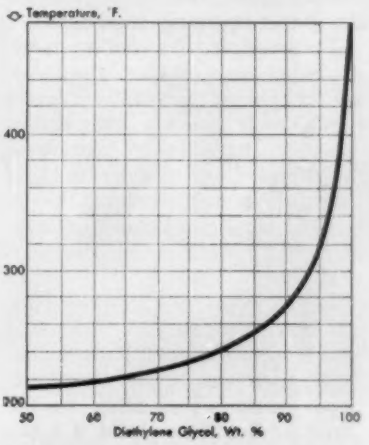


DIETHYLENE GLYCOL minimum withdrawal concentrations can be read from the above plot or calculated from the Hammerschmidt equation. Fig. 7.



USABLE concentration limits of diethylene glycol is shown on this plot of crystallization temperatures. Fig. 8.





REBOILER TEMPERATURES necessary to maintain proper concentrations of ethylene and diethylene glycol can be found from the boiling point curves in the above figures. Figs. 9 and 10.

"Complete recovery of the glycol is not feasible."

Comparison is now made between the quantities of ethylene glycol and diethylene glycol required for injection each hour. For ethylene glycol, Fig. 4 is used in the manner described previously. An injection rate of 4.35 lb. per pound of water is obtained, which when multiplyed by 14.5 gives a total of 63.1 lb. of ethylene glycol required per hour. The diethylene glycol quantity is calculated by the glycol balance technique illustrated in the previous section, and the requirement found to be 72.5 lb. per hour.

Thus, less ethylene glycol than diethylene glycol is required to provide the same degree of hydrate depression, and lower reboiler temperatures may be used with the former. In addition, ethylene glycol displays more desirable viscosity characteristics and may be employed at a lower circulation rate. Finally, the ethylene glycol exhibits a lower hydrocarbon solubility than diethylene glycol, hence solubility losses are lower.

Glycol losses

It should be borne in mind that complete recovery of the glycol is not feasible. Each day, a small amount of glycol will be lost as a result of vaporization and of solubility in the liquid hydrocarbon phase. These losses can be minimized by choice of glycol type and concentration. and by maintaining the proper operating conditions.

For example, if solubility in hydrocarbons is a problem, the use of ethylene glycol is indicated because of its lower inherent hydrocarbon solubility. In addition, because of the adverse effect of water on glycol solubility in hydrocarbons, the injection glycol should be maintained at as low a concentration as practical.

In the event vaporization losses are unusually severe, a higher-molecular-weight glycol is indicated. Since triethylene glycol has lower vapor pressures than either ethylene glycol or diethylene glycol, it is best suited for use under these conditions.

Solubility loss. Glycol losses due to solubility in hydrocarbons can be estimated rather easily. Let the following conditions be assumed:

Total gas handled per day	8 M.M.s.c.f.
Total hydrocarbon per M.M.s.c.f.	50 bbl.
Hydrocarbon specific gravity	4.5 lb./gal.
Injection-glycol concentration	70-85%
Solubility of glycol in hydrocarbon	0.01 wt. %

Calculations of glycol losses are then carried out in the manner shown below:

50 bbl./M.M.s.c.f. hydrocarbon
x 8 M.M.s.c.f.d. throughput

400 bbl./day hydrocarbon produced
x 42 gal./bbl.

16,800 gal./day hydrocarbon produced
4.5 lb./gal. avg. sp. gr. of hydrocarbon

75,600 lb./day hydrocarbon produced
0.0001 solubility of glycol, parts/part hydrocarbon

7.56 lb. ethylene glycol lost to hydrocarbon phase per day.

Glycol-hydrocarbon solubility studies have been reported by McMurray[2], Martinez[3], and Johnson and Francis[4].

It should be remembered that the solubility data referred to above are valid only for the particular hydrocarbon mixture reported and additional solubility work should be performed on hydrocarbon compositions very far removed from those given.

Furthermore, solubility losses can be greater than theoretical since separation of the glycol-hydrocarbon mixture is not always 100% complete in commercial equipment.

Vaporization losses can be calculated using the following derivation of Raoult's law:

$$\frac{VP}{760} \times \frac{MW}{359} \times \frac{492}{460+T} \times \frac{14.7}{\text{pisa.}} \times 10^6 = \text{vaporization losses lb./M.M. s.c.f.}$$

Where:

VP=vapor pressure of glycol at separator temperature
MW=molecular weight of glycol
T=temperature of separator, ° F.

Vapor pressure may be determined at the separator temperature by consulting Fig. 11.

To illustrate use of the equation, suppose T=+5° F., gas pressure=800 psig., and ethylene glycol is the hydrate depressant. From T and Fig. 11, the vapor pressure of the ethylene glycol is found to be 0.0013 mm. Hg. The calculation is then made:

$$\frac{0.0013}{760} \times \frac{62.1}{359} \times \frac{492}{465} \times \frac{14.7}{814.7} \times 10^6 = 0.0056 \text{ lb. ethylene glycol/M.M.s.c.f.}$$

At a daily throughput of 8 M.M.s.c.f. glycol loss=0.0056 x 8 or 0.045 lb. per day.

Other losses. The vaporization losses for glycol at various temperatures and 1,000 psig. are shown in Fig. 12. This graph may also be used to estimate losses at other operating pressures.

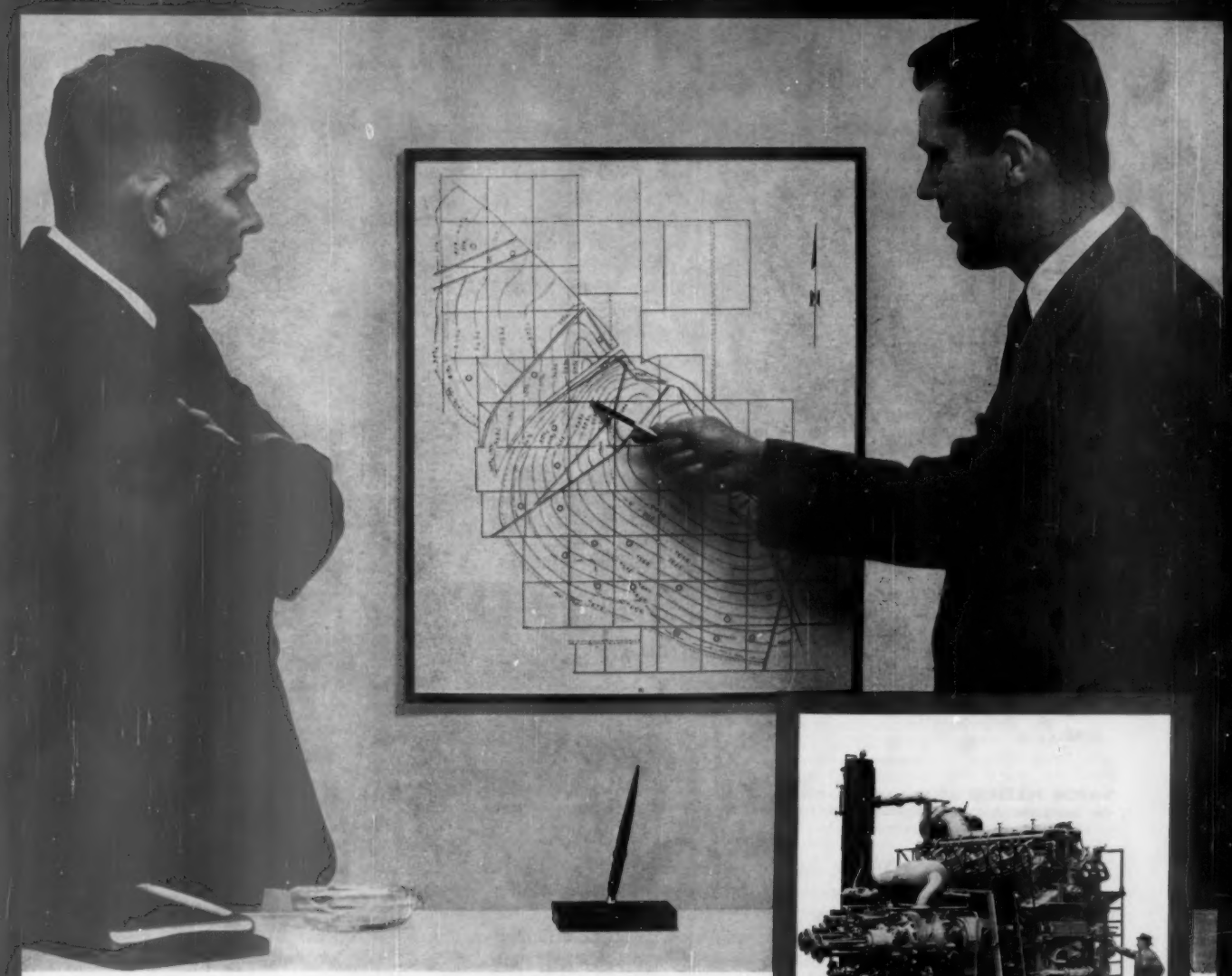
Foaming, excessive gas throughput, or partial plugging of the absorber trays can cause entrainment of liquid glycol droplets in the effluent gas. Mist eliminators are able to recover most of the entrained glycol, provided the capacity of the screen is not exceeded.

Loss of glycol from the reboiler still column should be insignificant if the unit is well designed. However, even in well-designed equipment, glycol losses from the still column can be excessive if the glycol contains much hydrocarbon that is volatile at the temperature of regeneration.

Glycol Maintenance Considerations

Laboratory studies [5,6] point out the need for controlling the pH of glycol solutions. Preferably, the glycol pH should be maintained slightly on the alkaline side, from 7 to 8.5. At levels below 5.5, autoxidation of the glycols takes place.

Autoxidation results in the formation of peroxides, aldehydes, and



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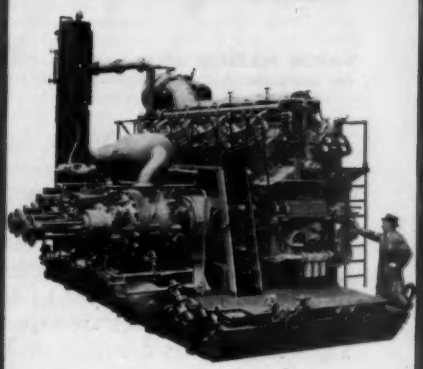

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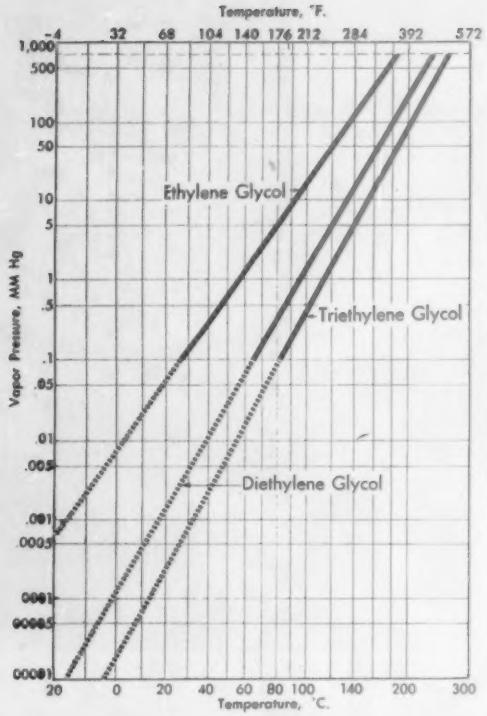
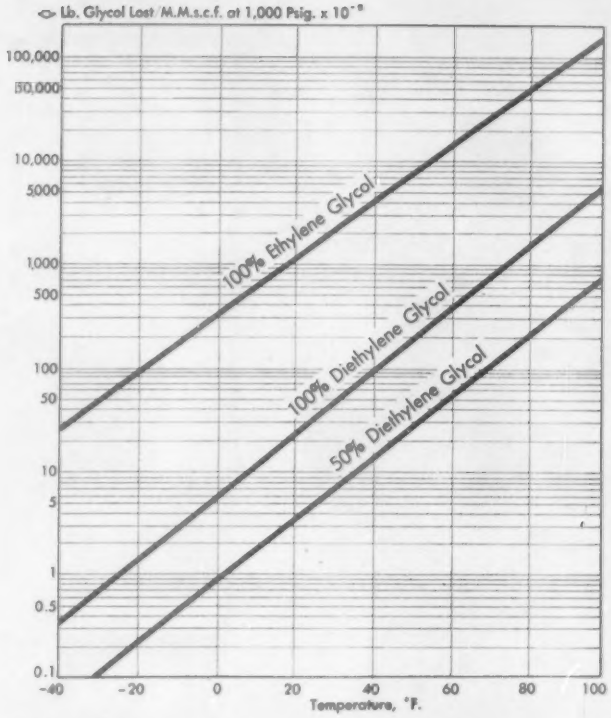


VAPOR PRESSURE of the various glycols at separator temperatures are plotted in this graph. Fig. 11.



VAPORIZATION LOSSES for glycol at various temperatures and pressures are illustrated on this chart. **Fig. 12.**

organic acids such as formic and acetic acids. These acids, along with any acid picked up from the natural-gas stream, will cause severe corrosion of mild-steel equipment. Sufficient inhibitors should be added to maintain the necessary 7 to 8.5 pH. The alkanolamines are especially well suited as corrosion inhibitors in glycol solutions for the following reasons:

1. The solubility of the amine in the glycol is not dependent upon water content.

2. Most acid gas-amine reactions are reversible; hence, the amine is regenerated in the glycol reboiler and becomes available for further use.

3. The amine can be easily titrated for reserve alkalinity determinations. Borax, NaCap, and K_2HPO_4 are also effective corrosion inhibitors for glycols in this particular service.

Contaminants may build up in the glycol to the point where they have an injurious effect on the over-all operation of the system. Such contaminants may include glycol degredation products, high-molecular-weight hydrocarbons, corrosion products, and gas-stream components with surfactantlike properties. Usually, these materials can be removed by filtration through activated charcoal, although vacuum distillation may occasionally be required.

Filtration of the glycol solution can be accomplished by the use of a replaceable cartridge filter that will remove particles down to 25-50 μ. This type of filter can be placed in the cold, rich-glycol line to conserve pump horsepower.

Glycol filters capable of removing particles down to 1-μ size should be placed in the hot, lean-glycol circuit in order to reduce the pressure drop across the filter due to the lower viscosity of the hot glycol.

Case Histories

The unit involved in case history No. 1 was an offshore installation with ethylene glycol injected at the wellhead. The glycol was recovered in a separation step, regenerated, and piped back to the wellhead to be injected over again.

Dow personnel were consulted following the development of a number of operating difficulties. These difficulties included:

1. Hydrocarbon contamination of the glycol solution, resulting in the plugging of the regenerator still and the carryover of large volumes of liquid hydrocarbons into the glycol storage tanks.

2. Glycol entrainment in the sales gas.

3. The formation of solids, with jamming of dump valves and control devices.

The rich glycol had a water concentration only 1% greater than the lean, indicating too high a circulation rate, insufficient contact, or both.

A review of the operation revealed a number of abnormal operating conditions. An excessively high regeneration temperature of 325° F. was maintained which resulted in the glycol solution being reconcentrated to 95.8% by weight rather than to the usual 60-80%. Fig. 6 shows that glycol at a 95.8% concentration has a freezing point of about −5° F. This high concentration and freezing point resulted in difficulties when the glycol-containing inlet gas was expanded through the choke in the low-temperature separation step. At this point, the gas temperature fell to —20° to —40° F. and crystallization of the

glycol took place. The dump valve became plugged by the slush and the separated liquid hydrocarbon-glycol-water solution flooded the separator and overflowed into the regenerator. Entrainment of liquids into the sales gas stream also occurred. Since the injection rate was several times higher than necessary, this further aggravated plugging by the solids.

The following recommendations were made based on an over-all analysis of the plant operating difficulties.

1. Reduce the regeneration temperature down to 230°-250° F. to yield a glycol solution having a concentration of 70-80% by weight. This lies within the noncrystallization zone of Fig. 6.

2. Reduce the injection rate to a value determined from preliminary calculations as previously discussed.

3. Drain and clean the hydrocarbons from the regenerator, storage tank, and the lines, and recharge with fresh 70% ethylene glycol.

4. During startup, monitor the three-phase separator to insure complete separation of the hydrocarbon.

As a result of these recommendations, operating difficulties in this unit were completely cleared up.

The unit in case history No. 2 was a low-temperature separation unit using glycol injection in conjunction with a conventional lean-oil absorption plant. Glycol losses were excessively high—averaging 46 lb. per M.M.s.c.f. of gas processed. The gas contained about 60 bbl. of hydrocarbon per M.M.s.c.f., 8 to 10% being aromatic hydrocarbon. The plant initially operated with diethylene glycol but due to the high aromatic content of the condensate, was converted to ethylene glycol. The glycol-condensate separator was operated at 0° F. with a residence time of 2 minutes.

A complete glycol balance was run on the system by sampling at every point where glycol could be lost. The information obtained when correlated with absorption-oil circulation rate, glycol circulation rate, and condensate volume indicated that an excessive quantity—18-20%—of hydrocarbon was going to the reboiler. Subsequently, this was flashed to the atmosphere, carrying glycol along with it.

As a temporary measure, a condenser was installed above the reboiler. This condensed the glycol and a portion of the water vapor while permitting the remainder of the water vapor and the hydrocarbon to escape to the atmosphere. The recovered glycol was separated from residual hydrocarbon and put back through the reboiler as make-up glycol. Glycol losses were reduced to 3 lb. per M.M.s.c.f.

Later, the condensers were replaced by additional separator facilities, resulting in still further reduction of glycol losses—to 2.5-3.0 lb. per M.M.s.c.f.

The use of an emulsion breaker was likewise found to contribute to lower glycol losses.

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Acknowledgment

The authors express their appreciation for the valuable assistance of Dr. Andrew Hart in the preparation of this article.

BOOKS

CORROSION PROBLEMS OF THE PETROLEUM INDUSTRY. Published by Macmillan Co., 60 Fifth Avenue, New York City 11. 235 pp. $6.

This book consists of papers read at a joint symposium organized by the Institute of Petroleum, the Corrosion Group, and the Chemical Engineering Group.

Following each paper is a record of the discussion which followed the reading of the paper.

Subjects covered included corrosion of production equipment and gathering lines, marine structures, tanker hulls, storage tanks and pipelines; corrosion problems arising in tubular heat-exchange equipment, corrosion control in reticulations using salt water, nondestructive testing in the oil refinery, and developments in corrosion-resistant materials, metal and nonmetals.

ROTARY DRILLING HANDBOOK. By J. E. Brantly. Published by Palmer Publications, 25 West 45th Street, New York City 36. 825 pp. $12.50.

A group of more than 25 engineers headed by J. E. Brantly, former president of Drilling & Exploration Co. and past president of AAODC, has prepared a new edition of the Rotary Drilling Handbook. The edition is the sixth in the series begun 25 years ago by Brantly.

More than 2 years in preparation, the sixth edition of the handbook has been completely rewritten in the light of new techniques and new equipment available to the drilling industry. It is 20% larger than the fifth edition published in 1952. It contains 31 chapters with 290 illustrations plus 206 pages of charts and tables to guide the driller, the tool pusher, and the drilling engineer in obtaining maximum efficiency and lower cost in making hole.

ASM METALS HANDBOOK, EIGHTH EDITION, VOL. 1,—PROPERTIES AND SELECTION OF METALS." Edited by Taylor Lyman. Published by ASM, Metals Park, Novelty, Ohio. 1,300 pp. $30.

A major article in this new ASM Metals Handbook deals exclusively with selection of steel for high-temperature service in petroleum-refinery applications.

It is a systematic treatment that begins with a consideration of material standardization, specifications, and codes, and then proceeds to a careful analysis of the metallurgical factors affecting the use of carbon, low-alloy, intermediate alloy, and stainless steels.

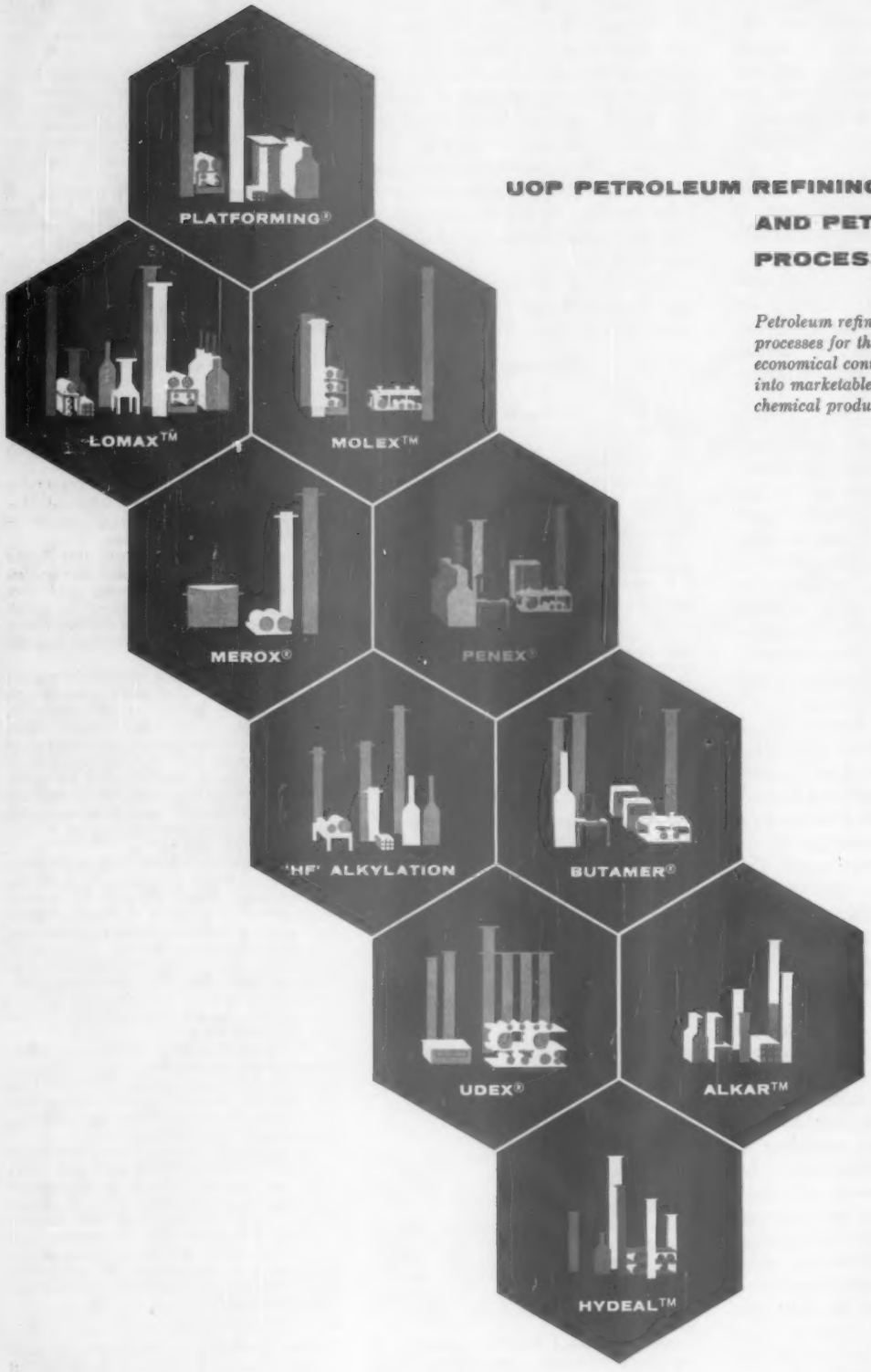
Its treatment of these subjects covers not only the phenomena of primary concern to the metallurgist (effects of spheroidization, graphitization, temper embrittlement, sigma phase) but provides exceptional coverage of field experience with all these materials. A total of 51 charts and 13 tables are given, including actual operating data obtained in refineries. Specific case histories clarify many of the problems encountered in materials selection and use.

For a book of its kind, dealing primarily with the properties and selection of metals, the treatment of steel selection for refinery applications is definitive in form, content, and scope. Companion articles on selection for high-temperature service in chemical processing, selection for corrosion service in chemical processing, and selection of high-temperature bolting materials will also be of specific interest to engineers in the petrochemical field.

The metals-handbook section on petroleum-refinery applications was prepared by an ASM committee headed by Dr. Carl H. Samans, director of the Engineering Metals Div., Research & Development Dept., American Oil Co., Whiting, Ind.

The handbook contains more information on corrosion of specific metals and alloys than any previous edition of this metal-working reference book. Twelve major articles deal directly with the subject, covering 133 pages, 272 illustrations, and 134 tables. Other articles complement this coverage with information on mechanical properties and fabric-ability of corrosion-resistant metals.

Note: The Oil and Gas Journal maintains a book department. Write to the READER SERVICE DEPARTMENT, P. O. Box 1260, Tulsa 1, for copies of the book list. Often books reviewed here may be purchased from this source.



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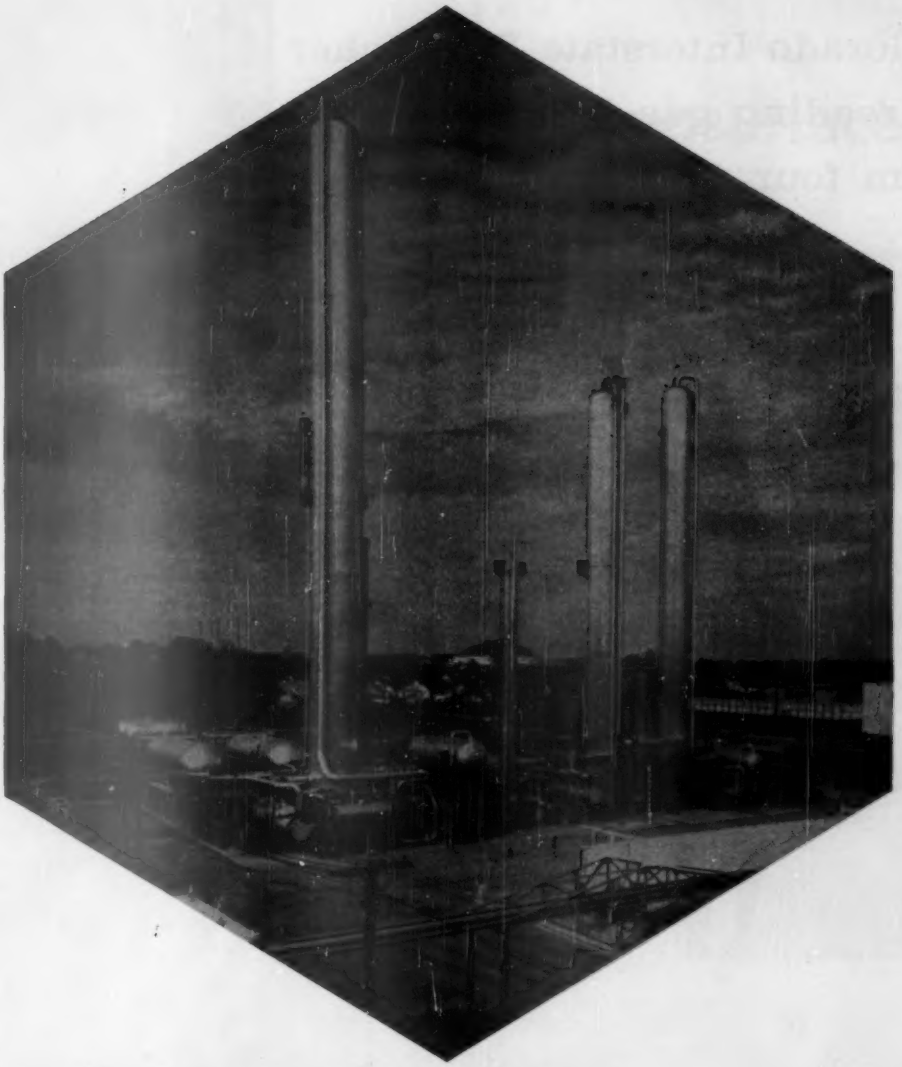

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Hydraulic pumping—the subsurface unit

BY JOSEPH ZABA

DESIGN DETAILS of different types of hydraulic subsurface units are described in the manufacturers' literature. Only basic principles of their operation are given here. Operating characteristics common to all the types will be first considered.

Every subsurface hydraulic production unit consists of a hydraulic reciprocating engine and a reciprocating pump arranged as a unit. The engine piston is connected directly to the plunger of the pump through a packed-off rod. Of importance is the ratio of the unit's piston and plunger sizes. The effect of this relationship is based on the fundamental law of hydraulics.

If the piston and the plunger are of the same size, then for each psi. of pressure to be exerted by the pump plunger, 1 psi. of pressure must be supplied to the engine piston. Also, with 100% efficiencies, for each barrel of power fluid supplied to the engine one barrel of well's fluid will be delivered by the pump.

If the piston is larger than the plunger, then for each psi. of pressure supplied to the piston more than 1 psi. pressure will be exerted by the pump's plunger. However, for each barrel of fluid delivered to the engine, less than a barrel will be delivered by the pump. This arrangement is used in deep pumping to reduce operating pressure requirements.

Conversely, if the pump plunger is larger than the engine piston, more pressure but less fluid must be supplied to the engine for the respective pressure and fluid deliveries of the pump. Units with this type of piston-to-plunger ratio are used in shallow to medium-depth pumping for handling large volumes of fluid.

The most important component of the hydraulic engine is the reversing valve. Designs of this valve differ, depending on the type of unit, but their function is the same in all cases. The reversing valve changes, within the engine, the one-directional flow of the power fluid to bring this fluid below or above the piston at the end of the piston's downstroke and upstroke.

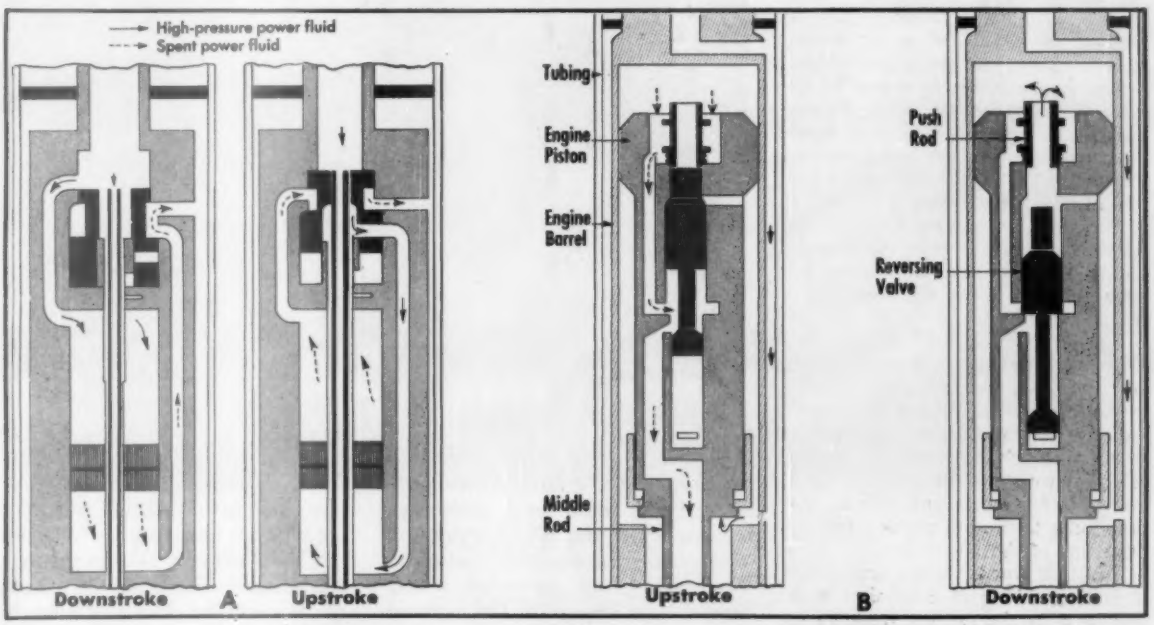
The clean, high-pressure power fluid is used as a lubricant for the sliding components of the unit. Different arrangements are used for this.

Depending on the way the pump portion of the unit operates, the hydraulic subsurface production units may be divided into double and single-acting.

Double-acting production units. A hydraulic subsurface production unit lifting fluid on both upstroke and downstroke was the one which started, about 30 years ago, the era of successful subsurface hydraulic pumping. Improvements in the unit, and in the system, contributed many new developments now used in all the hydraulic pumping systems.

The unit is of the short-stroke type, with a high-speed cycle of operation. Depending on the size of the unit the stroke ranges from 12 to 30 in. with the respective range of rated speeds from 91 to 58 s.p.m. The units are built in nominal sizes from 2 to 4 in. Since the pump is double-acting, one set of intake and exhaust valves is provided in the top and the bottom of the pump. The valves are of the multiple-ball, spring-loaded check-valve type. The engine piston and the pump plunger are connected through a short, hollow, hydraulically balanced rod. During each half of the cycle, the unit displaces half of the spent power oil and half of the production of the cycle. Lubrication with power oil is provided through a system of hollow rods and pistons.

The principle of operation of the



TYPICAL REVERSING VALVES of subsurface hydraulic pumping units. Fig. 57.

engine's reversing valve is shown schematically in Fig. 57-A. The valve rod has ports which, depending on the position of the rod, expose the bottom of the valve to the power oil or the exhaust pressures. This causes the movement of the valve. With the valve in the down position the power oil is directed to the top of the engine piston (downstroke of the unit). The spent power oil is exhausted from under the piston. With valve in the up position the power oil is directed under the piston (upstroke). The spent power oil is exhausted from above the piston. Throttling grooves and an orifice built into the valve offer means of controlling its speed and acceleration.

A relatively new development for increasing the volume pumped by a unit of any given nominal size is what could be called a tandem-pump unit. One engine operates two double-displacement pumps through a common rod. The pumps are arranged in tandem below the engine. Units with different combinations of engine piston and pump plunger sizes are available. For a given piston size the sizes of the pumps' plungers determine the displacement and the maximum setting depth of the unit.

Single-acting production units. The idea behind the development of the single-acting subsurface hydraulic pumping units was to use pumps operating in general on the principle of conventional sucker-rod pumps. They operate with longer strokes and sometimes with a slower cycle than the double-acting pumps, and their over-all length is greater. Fluid is pumped on either the up or downstroke. Three types are in general use.

The engine reversing valves of all three types are located within the engine-piston assembly and are operated hydraulically, or mechanically and hydraulically. Principle of operation of one of the latter type is shown in Fig. 57-B. During the upstroke the position of the valve within the piston is such that the spent power oil from the space above the piston is directed through the piston to the exhaust. At the end of the upstroke the valve is pushed off its seat by a special rod and is moved hydraulically to its bottom position where it remains during the downstroke, closing the passage through the piston. At the end of the downstroke the valve is again pushed off its seat and moved hydraulically to the top position for the beginning of the upstroke.

The first type of single-acting unit is built in 2½ and 2-in. sizes with lengths of stroke ranging from 64 to 52 in. and speeds from 22 to 25 s.p.m. On the downstroke the position of the reversing valve within the piston is such that the spent power oil flows through the valve from below to above the piston. During the upstroke the fluid from the pump and the spent power oil from above the piston are discharged into the production tubing where they are lifted to the surface. Special dash pots at the top and bottom of the unit furnish protection against shocks of the stroke reversals.

In some of its characteristics the second type, built in sizes from 2 to 3 in., is similar to the double-acting units. Strokes range from 22 to 35 in. and speeds from 64 to 50 s.p.m. Fluid is discharged uniformly during the cycle, the produced fluid from the pump during the downstroke and the spent power fluid from the engine during the upstroke.

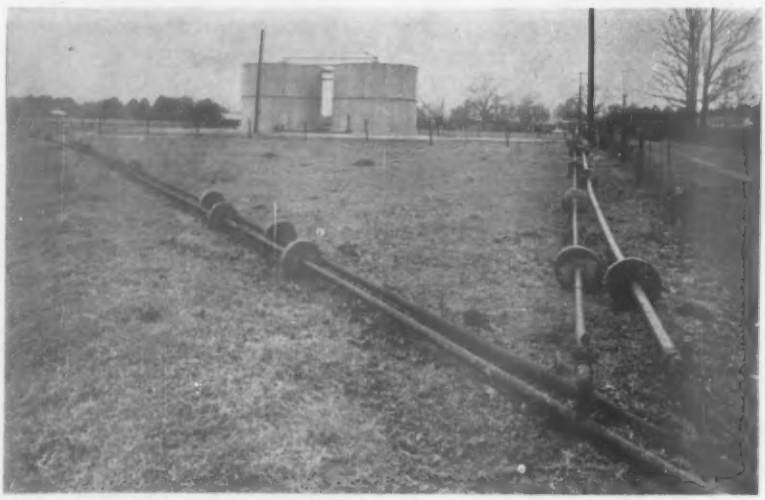
As far as their manner of operation is concerned the power-fluid pressure is applied to the bottom of the piston throughout the cycle. The downward motion of the piston is caused by the differential pressure resulting from the fact that the upper area of the piston is larger than the lower area.

During the downstroke the reversing valve admits power fluid above the piston creating the differential pressure and the well fluid is being displaced from the pump. During the upstroke the reversing valve stops the flow of power oil through the piston. The space above the piston is now connected to the exhaust for the spent power oil.

The units have several special features, one of them being the "flood valve." In the last inch of the upstroke, which is the suction stroke of the pump, the suction part of the pump barrel is connected to the spent power oil duct. The portion of well's suction not filled with the well fluid is filled with spent power oil, minimizing the shock loads of the fluid pound. Special design engines and pumps are available for large-volume pumping.

The third group is available in 2 and 2½-in. sizes, with strokes from 49 to 66 in. and speeds from 6 to 30 s.p.m. For the upstroke the oil is directed under the piston. The spent power fluid from above the piston travels downward through the piston and the hollow piston rod and mixes with production being discharged by the pump. At the top of the upstroke the reserving valve closes the passage through the hollow rod. The power oil is directed above the piston.

With the upper area of the piston larger than the lower area a differential pressure for the downstroke is created. The design of the ducts for the downstroke of power oil is such that the downstroke velocity of the piston can be controlled. This prevents excessive pistons speeds in case of pumped-off wells.



Concrete doughnuts

. . . help relieve some corrosion problems near Laurel, Miss. Purpose is to keep field gathering-system pipelines off the ground, minimizing electrolytic corrosion. Contraction and expansion with temperature change of the exposed pipe offers no problem because the center hole is large enough to permit free longitudinal movement of the pipe, and the doughnuts will roll if the pipe has any tendency to buckle.

Use of old pipe is safer this way, according to California Co. personnel, because the chance of leaks due to further corrosion is eliminated.

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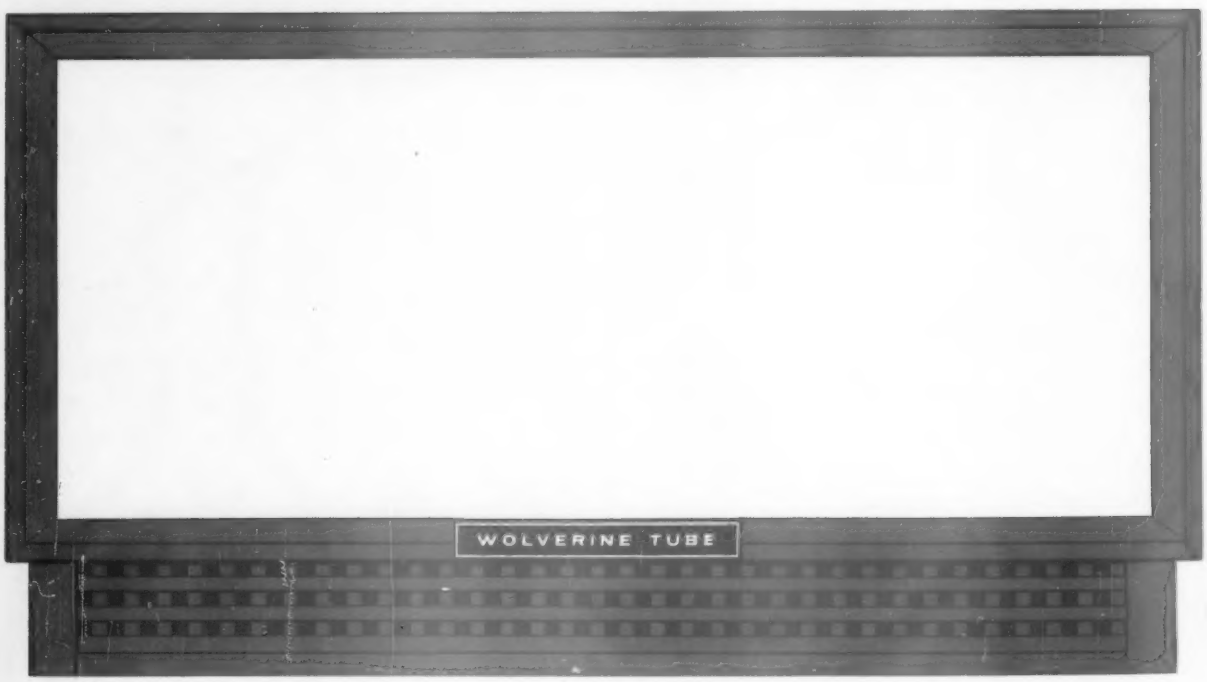

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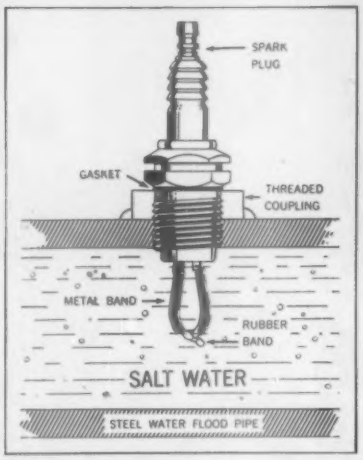
Is corrosion-repair cost corroding your water-flood profits? Here's how a $2 investment is saving thousands for Shell.

CORROSIVE CONDITIONS in a pipe carrying injection water are easily detected with less than $2 worth of equipment. Shell Chemist P. J. Raifsnider is shown demonstrating the use of the device he developed to cut down on the number of corrosion leaks that Shell had to repair. He calls it a . . .

Water-flood watchdog



CORROSION PROBE looks like this when installed in a water line. The sacrificial ribbon of steel is looped in the water stream. Purpose of the rubber band is to concentrate corrosion of the steel in one spot. If the loop breaks, the electrical circuit is also broken, and a simple test outside the pipe will show that more inhibitor is needed in the water stream.

A SPARK PLUG, a rubber band, and a thin ribbon of steel are working together to save Shell Oil Co. thousands of dollars.

Sounds fantastic, but these materials, costing around 2 dollars, are being used to detect early corrosion in pipelines carrying injection water to input wells in secondary-recovery projects. This development was first reported in Shell News for March 1961.

Big annual cost. Shell has spent as much as $100,000 a year repairing leaks and replacing pipe damaged by corrosion. The company is involved in more than 50 water-flood projects in 9 states. Last year's production from these fields was 6.6 million barrels of crude.

Source of trouble. Studies conducted by Chemist P. J. Raifsnider at Shell Development Co.'s Emeryville research center showed that the basic cause of corrosion was traces of oxygen in the injection water. The oxygen itself was not harmful, but deposits of scale and dirt on the inside of the pipe created areas of oxygen unbalance. An electrical field resulted, and a stream of ions was released from the inside of the pipe wall, and went into the water.

Raifsnider solved the problem by adding a chemical scavenger to the water. All traces of oxygen were removed. But some simple device was needed that would show when conditions were corrosive, and when chemical treatment was needed.

Then Raifsnider came up with the spark-plug idea. The steel ribbon is welded to the electrodes of the spark plug, and the rubber band is tied around the resulting loop. When the spark plug is threaded into the side of a water line, the looped steel ribbon is suspended in the water stream.

Purpose of the rubber band is to simulate the collection of dirt and scale that caused corrosion to be concentrated in one small spot. If corrosive conditions exist in a water line, the first place where damage will occur is under the rubber band. And it won't take long for corrosion to eat through the thin metal strip.

How used. With a flashlight battery and bulb, the electrical circuit between the electrodes can be easily tested. With one of the battery terminals connected to the center post of the spark plug, and the other touching the wrench flats, the bulb will light if the steel ribbon is still intact. If the ribbon fails due to corrosion, the circuit will be broken and the bulb will fail to light.

If a corrosive condition is found, more inhibitor is added to the water stream, to combat the effects of oxygen.

Successful. In the Joy water-flood project near Wichita Falls, the watchdog has proven its effectiveness. Each week about 20 pipe leaks were repaired until the spark-plug units were installed. During the first year after installation, only one leak was noted.

Shell is now using the device in major water-flood projects in California, Illinois, and Texas, and is well pleased with the results.

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Republic looks into the microstructure of steel

To save you money, Republic is working to boost the reliability of pipe, by increasing the fatigue resistance of steel.

Metallurgists are attacking the problem of nonmetallic inclusions in steel, for example, learning how to locate, identify, track, and eliminate them.

Such an inclusion—*magnified more than 33,000 times*—is seen at left as photographed through an electron microscope.

Invisible to the naked eye, this inclusion was removed from surrounding steel by a drill small enough to put two holes, side by side, across the thickness of a human hair. It proved to be a nonmetallic substance of crystalline structure. Recurrence was *eliminated* by a slight variation in the raw material mix.

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Strong, Modern, Dependable

A refinery is born

The first stirrings on the site of a refinery-to-be. The scene here is in **Belfast, but it is typical** of many other sites – in Europe, Africa (North, South, **East and West**) and the Middle East.

In sixteen widely separated places refineries are being planned or **built** or are undergoing major expansion by BP and its associates... **tangible** symbols of progress with British Petroleum.

BP

PROCESS AREA of Canadian Oil's new Alberta refinery. On right side of pipe alley are crude unit and facilities; On left side, the compressor house plus Platformer and Unifiner. Process area has been arranged so that it is a single unit instead of a collection of scattered units. Fig. 1.

Here's a "compact" model refinery

that features fully integrated process units, electronically controlled and air cooled, and flexibility in feed stocks

THE NEW Alberta refinery of Canadian Oil Cos., Ltd., is an efficiently compact and highly automated plant embodying a number of unusual features. The fully integrated process units have been designed to process natural-gas condensate or a mixture of condensate and crude oil to provide flexibility in feed stocks.

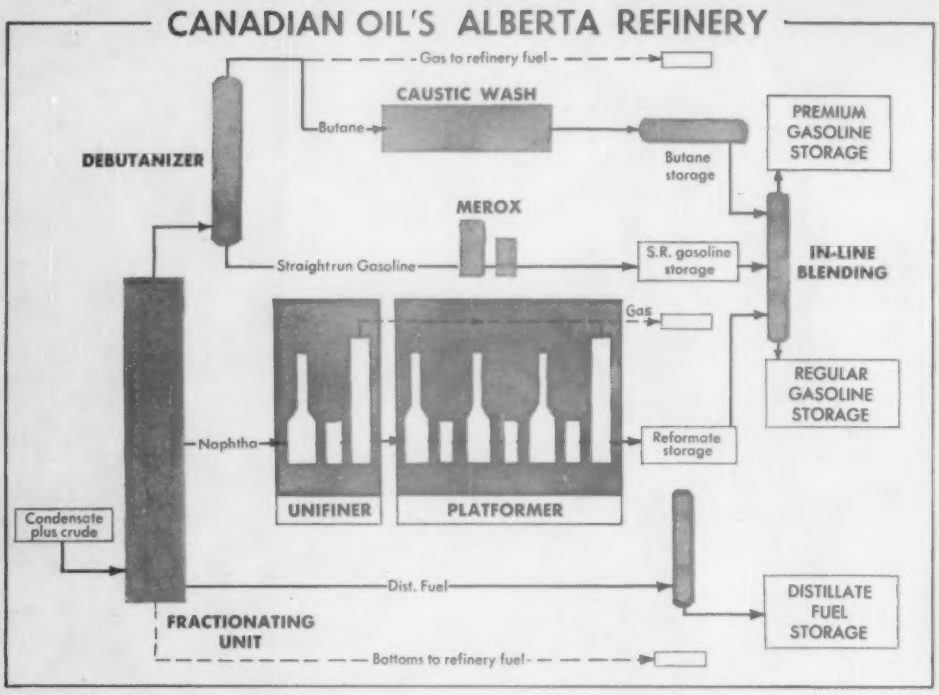
Located a few miles south of Innisfail, the new refinery cost approximately $4,000,000 and has a capacity of 5,000 bbl. a day. Major factors in the location of the refinery were present and future sources of suitable condensate and the accessibility of the White Rose marketing organization in Alberta. Major part of the feed stock comes from a gas-processing plant near Innisfail, fed by a group of producers at Innisfail oil field.

The condensate has a high gasoline yield of about 80%, with about 19% distillate fuel.

Simplicity of design and ease of maintenance were prime factors in the selection of the refinery's process units which consist basically of four main units—feed fractionating, Merox treating, Unifining, and Platforming. The units have been arranged in a closely integrated pattern so that the process area is in reality a single unit.

Processing is carried out almost entirely under electronic control. The new refinery is thought to be the first in Canada to achieve all process cooling with the use of air-cooling units. The refinery is designed to use only 15 g.p.m. of water. All major vessels and piping have been oversized so that capacity can be doubled later for the minimum of capital investment.

The refinery area occupies 22 acres of a 320-acre company-owned site about 65 miles north of Calgary and 125 miles south of Edmonton.



WITH closely knit process units, the need for intermediate storage is almost eliminated. Fig. 2.

Refinery engineering and construction were executed by Canadian Bechtel, Ltd., main contractor.

Construction was begun in the fall of 1959 and the refinery went on stream in fall of 1960. Altogether there were 216 construction days as work was stopped during the winter months.

Integration. The process area is a single integrated unit, rather than the more usual collection of individual process units. The four main processes, feed-stock fractionating, Merox treating, Unifining, and Platforming, together with the auxiliary equipment, are closely knit on the natural process flow of the product, Fig. 1. This eliminates large-scale intermediate storage facilities and pumping requirements although provision has been made for emergencies. Because the feed stock is fed directly from one process to another the reheating requirements are minimized, less piping is needed, a smaller plot plan is permitted, and control of the entire processing operation is more easily consolidated.

Instrumentation, control. Practically the entire processing cycle at the new refinery is controlled from a central panel. This keeps operator requirements to a minimum and allows more precise control of processing conditions. Electronics are used for the sensing devices at the process units, for recording and indicating instruments on the control panel, and for controlling the pneumatically operated process valves on the units.

Air for the valve-operating system is completely dried in a silica-gel drier that absorbs moisture. The gel is redried in an unusual way. Pressurized air is released in the silica gel, and as it expands it soaks up the moisture rather like a squeezed sponge will soak up water when released. Thus drying is instantaneous, whereas the usual method of heating a coil in the gel takes some time. The air is also filtered for dust and possible oil vapors.

The electronic control system gives fast and sensitive response, immunity to weather conditions, ease of maintenance, and standardized unit components for easy replacement. There are 80 electronic loops, 44 with chart recorders and others with indicators. The control panel has permanent line diagrams to assist the operators to visualize the process. Some of the electronic loops have standby direct-reading instruments on the units.

The storage tanks are gaged from the control room. A code number for a particular tank is dialed on an instrument similar to an ordinary telephone and the amount of product in that tank appears in a window above the dial.

Automatic printing meters are provided at the loading dock to facilitate accounting procedures and to free drivers to do their own loading.

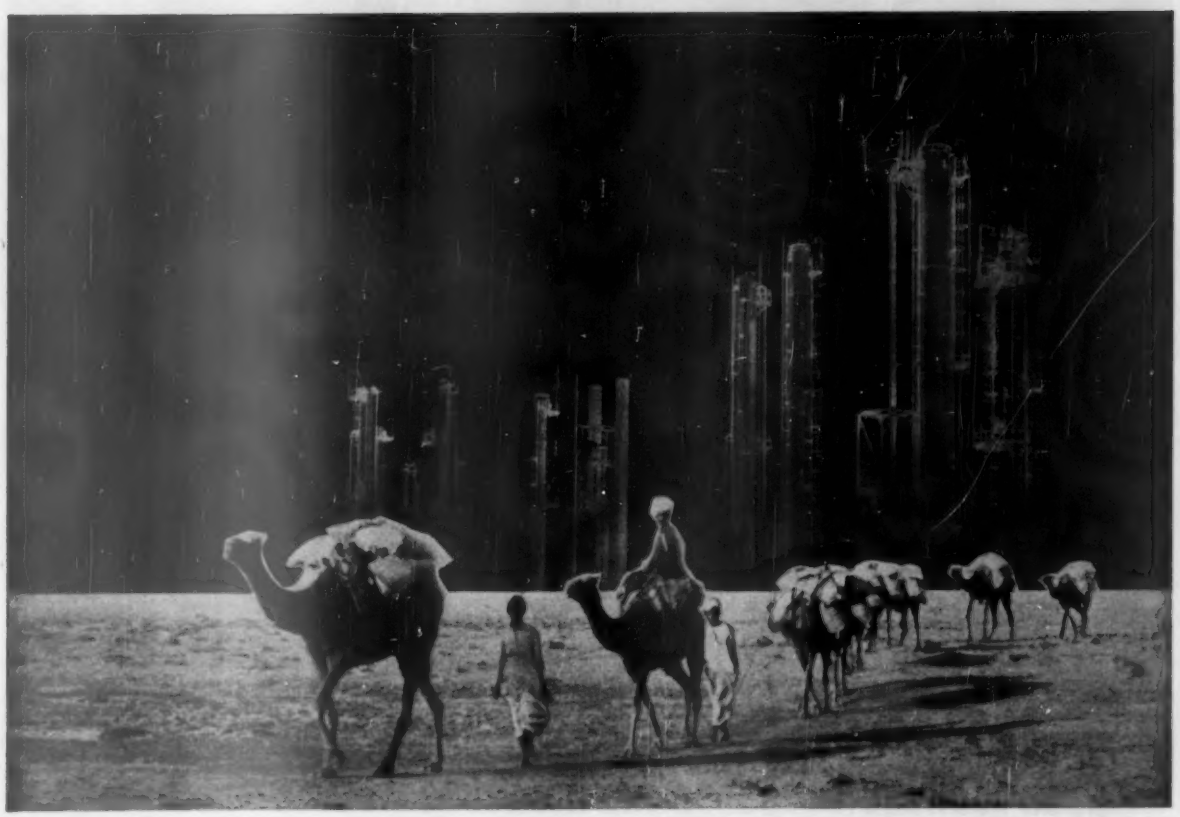
A public-address system connects the control room to all strategic parts of the refinery.

In-line blending. There is a separate control panel for the in-line blending system. This system automatically meters different product streams from the process unit and mixes them with inhibitors, dyes, tetraethylead and total ingredients in the correct proportions at 360 g.p.m. before putting the finished product to storage.

Intermediate storage tanks and piping are thus kept to a minimum. The three main gasoline components—straightrun gasoline, reformate, and butane—are contained in small rundown tanks which serve more as surge tanks than storage. The indicating instruments in this system are electronic with the metering equipment controlled and operated pneumatically from the blending house.

Electric drives. To reduce dependency on stream, all pumps in the new refinery, except one, have electric drives. An uninterrupted power supply is assured by having

MAKING A MIRAGE MATERIALIZE



PAKISTAN'S FIRST OIL REFINERY NOW BEING BUILT BY KELLOGG

for British-Dutch-American consortium

Construction activities are well under way on Pakistan's first refinery, near Karachi. Simultaneously, details of procurement—a world-wide operation—are being coordinated in Kellogg offices. Completion of the project is scheduled for the latter part of 1962.

The Kellogg organization will be completely responsible for this 35,000 BPD refinery to Pakistan Refinery Limited. The Burmah Oil Company, Caltex, Shell, Stanvac, together with Pakistani interests, all participate in Pakistan Refinery Limited. Technical coordinator for the consortium is Bataafse Internationale Petroleum Maatschappij.

Important considerations in the selection of the Kellogg organization were cost, speed, ease of maintenance, and the proved ability to undertake and coordinate every phase of engineering, procurement, and construction. Kellogg's contract assures the minimum initial investment and operating costs consistent with good refinery practice and proper safety standards.

For companies considering oil refining or petrochemical manufacturing facilities overseas, Kellogg's international organization offers the optimum return on investments and the soundest kind of economic aid to friendly nations.

THE M. W. KELLOGG COMPANY

711 Third Ave., New York 17. *A subsidiary of Pullman Incorporated*

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Toronto, London, Paris,
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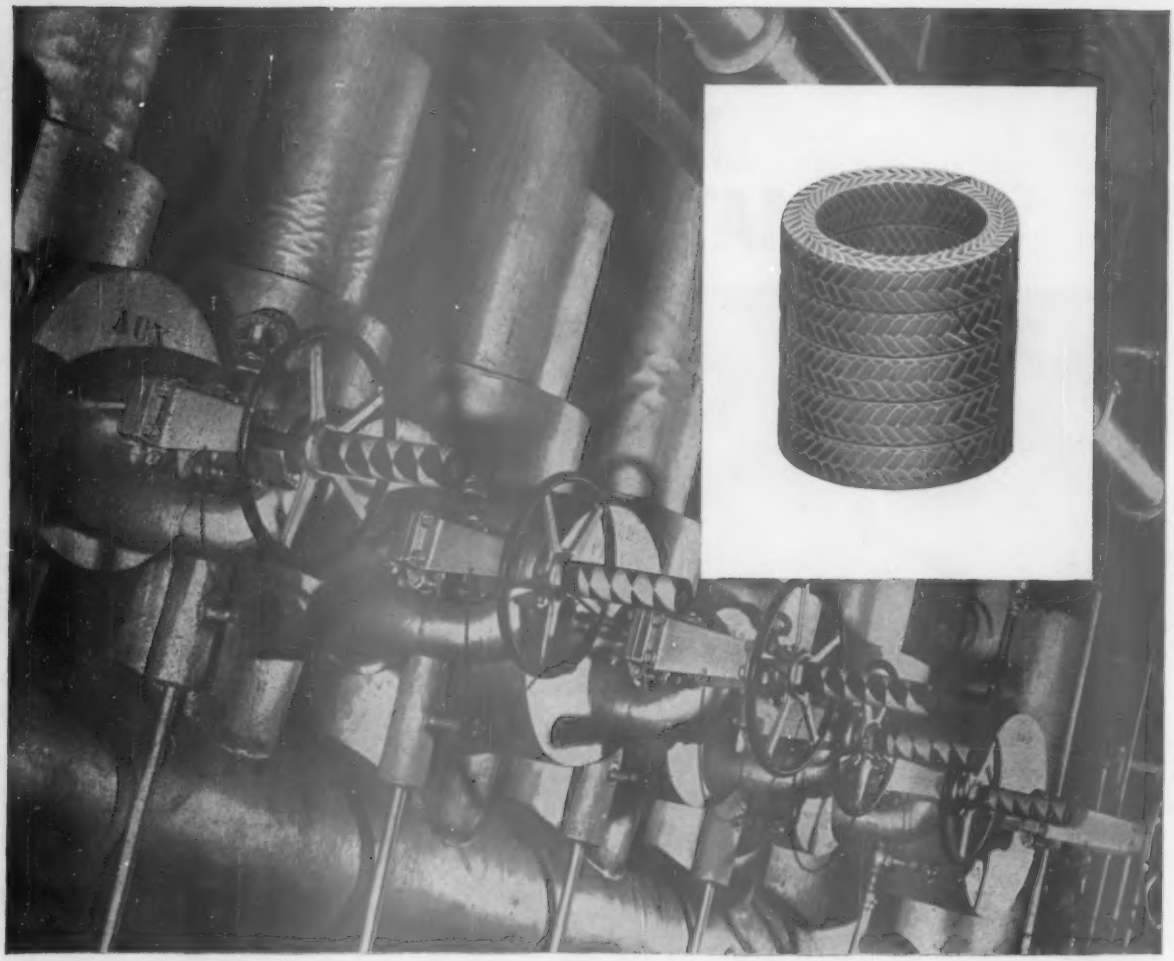


Packings of asbestos and TEFLON® TFE in 7 boiler valves stopped leakage...reduced maintenance...saved $280 per year

The packings: asbestos impregnated with a Du Pont TEFLON TFE-fluorocarbon resin. The application: main distribution control valves on the boiler header shown above, handling steam at 150 psi and 356°F. The performance advantages: the packings do not leak . . . do not need retightening . . . last indefinitely . . . valves turn easily without "persuaders". Unlike oil, grease and graphite additives, which squeeze out and leave a dry, abrasive base, the impregnations of TEFLON make a lasting mechanical bond with the asbestos. The cost savings: average savings per valve of $10 per year on repacking and retightening formerly necessary, and $30 per year formerly lost through leaking steam—a total saving of $280 per year for the 7 steam valves.

Under more severe service conditions, such as are often encountered in the petrochemical industry, there are additional decisive reasons for choosing these all-purpose packing materials. TEFLON resins are inert to virtually all chemicals and solvents, over a temperature range from –450°F. to 500°F. Their low-friction characteristics reduce wear on cylinders and shafts.

These facts have been put to the hard test of dollars-and-cents cost accounting in many hundreds of applications. In addition to reduced costs of packing maintenance and replacement, the use of TEFLON permits standardization, cuts down inventories of many different types of packing. Consult your supplier about the many varieties of constructions available in packings made with TEFLON, and write for new booklets: "Packings for Valves and Pumps", and "Designing with TEFLON". Address: E. I. du Pont de Nemours & Co. (Inc.), Dept. OG-73, Room 2507T Nemours Building, Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

DU PONT REG. U. S. PAT. OFF. TEFLON® FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins.

two independent feeders, one from Calgary and the other from Edmonton, with an automatic switching arrangement between the feeders. There is also an emergency generator powered by a V-8 120-hp. gasoline engine. In the unlikely event of both power sources being cut off at the same time, the emergency generator automatically cuts in.

Minimum use of liquid cooling. Liquid cooling is used only for pumps circulating hot liquids. A mixture of glycol and water is used in a system resembling a giant automobile cooling system. In this way the same water is reused instead of being returned to waste as is usual in most refineries.

Winterizing. The main uses for steam in the refinery are building heating and steam tracing for winterizing purposes. Miles of small-diameter copper tubing are stretched along pipes, around tanks and drums, and across instruments likely to be affected by Alberta's rigorous winter. High-temperature steam is passed through the tubing, preventing ice from forming and keeping the viscosity of feed stocks at a practical level.

To guard against the loss of required heat, process piping and vessels are insulated with up to 3 in. of mineral fiber. To improve appearance and protect the mineral fiber against bad weather, towers and piping have been clad with aluminum sheeting.

Feed-stock fractionating unit. This unit is operated as a conventional pipe still. The primary heater operates on gas and heavy bottoms from the fractionating unit. Four streams, straightrun gasoline, naphtha, distillate fuel for diesel and domestic fuel oil, and heavy bottoms, are taken off from the tower.

The distillates go to a reboil stripper which removes volatile light ends by boiling and then to storage. The straightrun gasoline is totally condensed in an air-fin cooler and charged to the debutanizer column for removal of butane and other light ends. It then becomes the feed stock for the Merox unit. The naphtha cut is reboil-stripped of light gases and then becomes the feed stock for the Unifiner.

Butane from the debutanizer is cooled, and lighter ends are bled off to the fuel-gas system. The butane is treated in a caustic wash for sulfur removal and a water wash for removal of process caustic. It is then passed to storage.

Merox unit. The straightrun gasoline is first treated in a caustic wash to remove hydrogen sulfide and then is charged to the Merox reactor. The unit is one of the few to use a solid-bed catalyst, which is cobalt organic compound supported on a carbon base. This catalyst sweetens the gasoline by removing mercaptan sulfur. Final removal of process caustic is achieved in a filter vessel before the product is sent to storage.

Unifiner. Naphtha from the fractionating unit joins hydrogen-rich gas and is heated in exchangers before being fed to the unifiner where sulfur compounds are removed.

The desulfurized naphtha is feed stock for the Platformer which converts the low-octane material to a high-octane reformate.

Transportation. A prime consideration in the location of the refinery was the sources of probable future supplies of natural-gas condensate suitable for the refinery's operations. These appeared to be the Mississippian gas field in the Carstairs-Crossfield area and the Devonian gas caps in the Dick Lake and Homeglen-Rimby area. The site chosen was between the two about 30 miles north of Carstairs, the current source of supply.

After a detailed study of road and pipeline transportation of the feed stock, an unusual solution was found in the combination of the two methods. Home Oil Co.'s gas-processing plant at Carstairs is about 7½ miles from the main Calgary-Edmonton highway. Truck movement along the road from the highway to the gas plant is restricted in the spring thaw, so it was decided to construct a pipeline from the plant to a special terminal on the highway. A special tank truck was constructed with the sole job of transporting feed stock to the refinery.

The terminal has a 1,000-bbl. tank equipped with an automatic hydraulically operated control valve permitting the terminal to be unattended. Truck drivers load their own trucks. A "no flow" switch at the Carstairs end of the pipeline shuts down the pipeline pump when the terminal valve closes.

The tank on the tractor-trailer is welded aluminum with a 6,700-gal. capacity. It is pulled by a gasoline-engine tractor, rather than a diesel tractor, since the gasoline engine is lighter. This allows more feed to be hauled for the 72,000-lb. weight maximum permitted by the provincial government. It takes 10 minutes to fill the tank at the terminal and 15 minutes to unload at the refinery. The drivers are responsible for both operations.

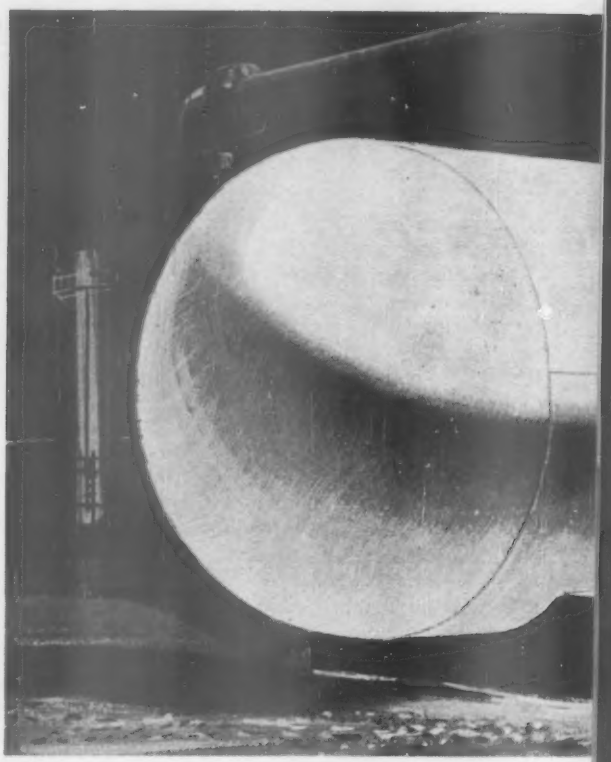
Marketing department facilities. Dispatching of finished products is handled by Canadian Oil's marketing department from facilities at the rear of the refinery.

There are three loading islands, covered by a continuous canopy, with four outlets on each. The drivers are responsible for the loading of their own trucks and automatic printing meters provide an accurate accounting. Four loading pumps are provided—one of which is a common standby pump. It is possible to load as many as six trucks at one time with an average loading time of about 10 minutes each.

Safety. All main pumping stations are in the open in accordance to latest safety practices so that vaporous hydrocarbons are immediately dispersed.

A somewhat unusual principle of fire-fighting has been employed, with the emphasis on fixed equipment, rather than mobile fire units. This enables operators to go straight to the scene of a fire without having to go first to a fire-fighting station. The fire circuit is pressurized by two pumps, one electric and the other a steam turbine (the only steam turbine pump in the refinery) capable of pumping 1,000 g.p.m. and producing a pressure of 100 psi.

Personnel. Because of the high degree of automation and the many unique features of the refinery, it is possible to operate it efficiently with the minimum of manpower. There are one day foreman, one shift foreman, and three shift operators. A special initiation course was given to all operators and key personnel on the many unusual features and work duties in this refinery. Maintenance and administration staff have likewise been tailored to the refinery's needs so that the total work force employed is 26.



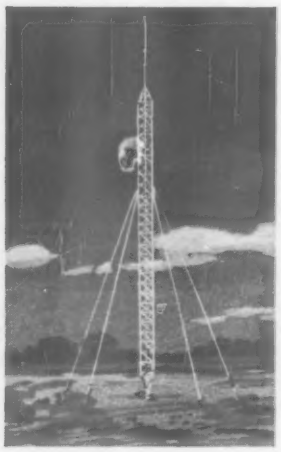
SSS 100 ALLOY STEEL

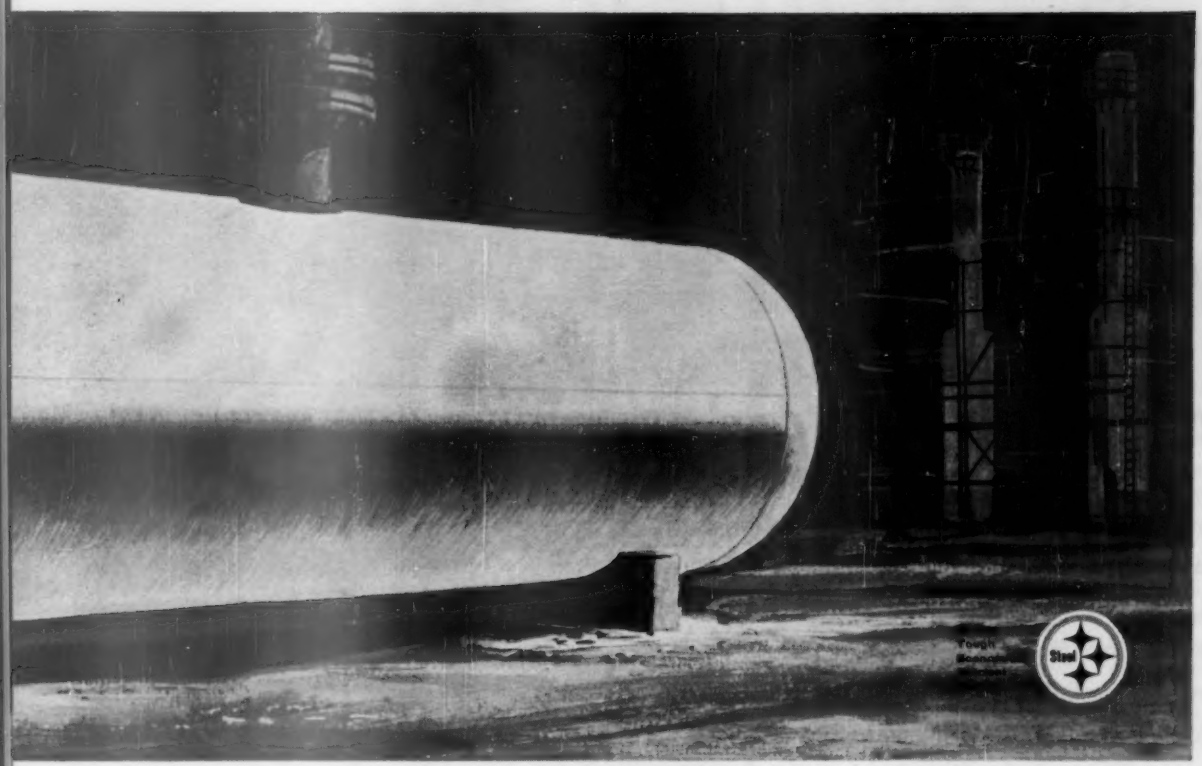
A.S.M.E. Approved

SSS-100 is approved for use in the construction of welded pressure vessels according to the requirements of Section VIII of the ASME Boiler & Pressure Vessel Code (Case No. 1298—Special Ruling).

Sheffield's New SSS-100 Meets

(Triple S-100)





Growing Need For Tougher Steel

Quenched and Tempered Alloy Constructional Steel With New Weight-Saving Strength—Greater Durability Under Punishing Loads—Excellent Weldability for Easier Fabrication.

Here it is! Sheffield's answer to the challenging need for steel with new qualities to meet the pressures of today's construction:

New Sheffield SSS-100	
Tensile Strength	115,000 psi minimum
Yield Strength	100,000 psi minimum
Elongation (in 2 inches)	18% minimum
Reduction in Area	50% minimum

SSS-100 may be furnished to requirements of ASTM A-300 at –50°F in firebox or higher quality levels.

SSS-100 is the steel to specify—to demand—for storage tanks and pressure vessels, bridges, earth movers, heavy construction machinery, transport equipment, tank trucks, TV towers, fabricated structural shapes, missile ground-support equipment—any application that calls for a versatile combination of high strength, toughness and excellent weldability.

Sheffield SSS-100 is available in plates from $\frac{3}{16}$ to 2 inches thick, in blooms and billets for forging and subsequent heat treatment. Heat-treated bars can be furnished on inquiry. Also supplied heat treated to 321 minimum Brinell for use where resistance to impact abrasion is required.

For complete information and technical service, write **Sheffield Division, Armco Steel Corporation, Attention Alloy Sales, P. O. Box 3129, Houston 1, Texas.**

ARMCO Sheffield Division

AFTER TEST RUN, rollers can be substituted for brushes when pig is to be solely for removal of water.

Here is a pig that contracts or expands as it moves from one diameter section of pipeline to another. It has proved effective in 18-months service on 6 to 10-day pigging schedule in 16 and 20-in. line. Rollers can be substituted for brushes when water only is to be removed.

DUAL-SIZE PIG is removed from receiving trap. Triangular brushes are mounted on arch springs which also keep pig centered in line.

Self-adjusting pig removes dirt, water from dual-size line

BOTH DIRT AND WATER can be removed effectively from a dual-size pipeline. The device for performing this job is a self-adjusting pig of radical design.

This pig can do both jobs simultaneously. Or it can do either job more readily when adapted for that particular service.

The first of these dual-size pigs has been in use for approximately a year and a half. This extended period of severe and constant service has demonstrated its value.

The first one was designed for a 20-in. and 16-in. line of El Paso Natural Gas Co. between Aneth, Utah, and Farmington, N. M. This line is approximately 80 miles long with 60 miles of 16-in. and 20 miles of 20-in.

Before being put into regular service, the pig was tested on a 10-mile line consisting of 4 miles of 16-in. and 6 miles of 20-in. This line included 37° bends which had been fabricated from long-radius tube turns. It passed these bends without trouble.

After it had successfully passed this test, the pig was put into regular service on the longer line. It has since been in continuous service for approximately 18 months on a 6 to 10-day pigging schedule.

In its initial design, the dual-size pig was equipped with both front and rear sealing elements using a unique Siamese-twin type flap. This flap contracts or expands as the pig moves from pipe of one diameter to a smaller or larger line. This reduces the wear common to previous dual-size flap designs.

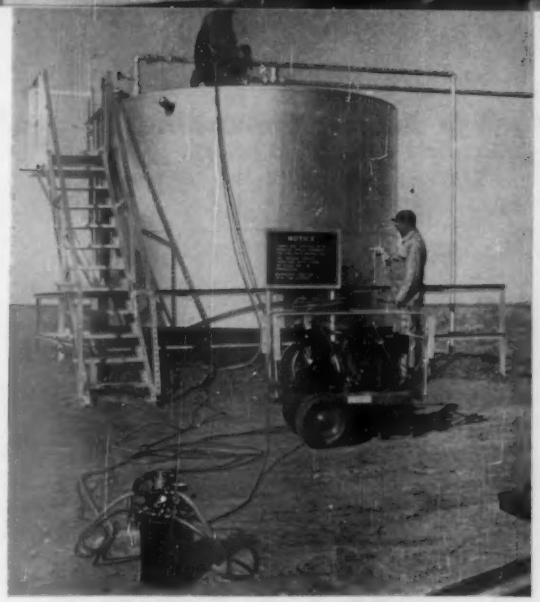
Cleaning elements are T-type triangular brushes mounted on arch springs. These springs support both brushes and sealing elements and also keep the pig centered in the line.

A subsequent design change has made is possible to substitute rollers for brushes when the pig is to be used solely for the removal of liquid. This increased the life of the sealing elements from two runs, when equipped with brushes, to three or four runs when equipped with rollers. The average life with rollers is about 300 miles per set of flaps.

The dual-size pig, designated TUS-2CD by the manufacturer, T. D. Williamson, Inc., not only improves line efficiency but also moves the liquids to a single accumulating point. This eliminates the costly blowing of drips and long-distance trucking of liquids.

Successful use of the dual-size pig overcomes one of the disadvantages of dual-size lines, the difficulty of removing dirt and liquid. The ability of the new pig to clean dirt from the pipe wall and move liquid gives a unique advantage.

Since the first pig proved successful, a second has been put into use.



COMPACT paint cart built almost entirely from scrap material by production crews at Panhandle Eastern's Elkhart and Liberal, Kans., stations. Lawrance E. Hibler, right, and Lee Smith, both of Elkhart, demonstrate its use.

Compact paint cart saves time, cuts wear

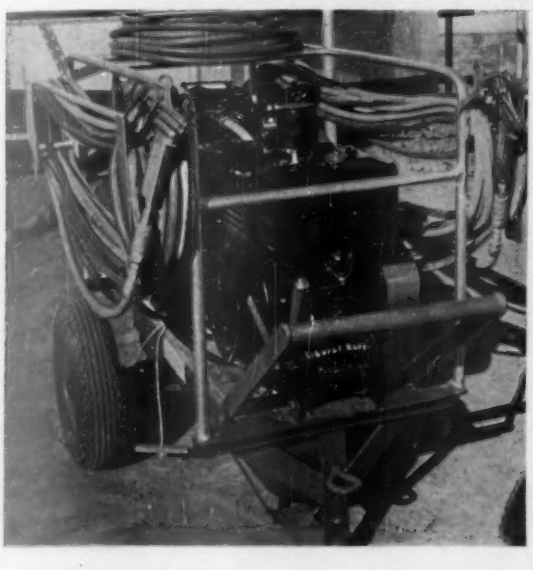
THIS compact paint cart, shown in operation (above) and in a closeup (right), was conceived, designed, and built by the production crews at Panhandle Eastern Pipe Line Co.'s Liberal and Elkhart, Kans., stations. It saves time, protects equipment, and adds to convenience.

Among its features are supports for the hoses. These supports replace boxes used with previous equipment. The two 50-ft. double hoses and the 50-ft. hose to the paint pot are coiled on these supports which makes them easier of access and lessens the wear. A special holder for the paint pot is part of the cart's equipment.

Power for the unit is taken from a truck battery by jumper cables. A ramp is provided for loading or unloading the cart from a truck. The ramp was the single piece of equipment that had to be purchased new.

Practically all other parts of the cart were made from scrap pipe and angle iron. The starter motor was purchased for $2.

Previously it took the crews a half hour to set up and an equal length of time to break down. Now either operation takes only a few minutes and, in addition, the equipment, especially the expensive hoses, is subject to considerably less wear and tear.



HOSES are coiled on supports to make them more accessible and less vulnerable to wear. Paint pot has special holder. Guns are strapped to hose supports. The starter motor is behind pull bar.

COMPRESSOR and fuel tank are mounted on trailer to speed movement from job to job.

Trailer-mounted unit speeds line crossings

FACED with numerous road crossings, this pipeline contractor has mounted a compressor unit, complete with fuel tank, on a semi-trailer. As soon as one crossing is completed, the entire unit is moved to the scene of the next one.

All of the equipment is air operated. The trailer is parked over the crossing so that air can be supplied to either end. While the unit is spotted on a job, the truck can be disconnected and used for other purposes.

Nine acts cause 80% of injuries

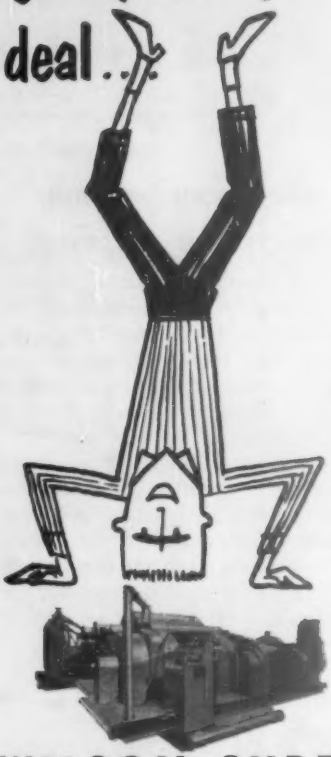
NINE TYPES of unsafe actions cause 80% of all injuries according to the National Safety Council's publication, "Petroleum Industry." It lists them as follows:

1. Operating without authority.
2. Operating at an unsafe speed.
3. Bypassing safety devices.
4. Using unsafe equipment.
5. Unsafe loading or placing or mixing or combining.
6. Taking an unsafe position or posture.
7. Working on moving or dangerous equipment unnecessarily.
8. Horseplay of various types.
9. Failure to wear personal protective devices.

And here's what to do about them:

1. Stop unsafe action.
2. Study the situation.
3. Instruct the violator.
4. Train by repeated instructions.
5. Discipline by good example.

We'll stand on our heads to give you a good deal...



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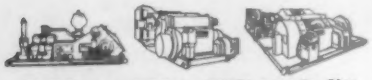
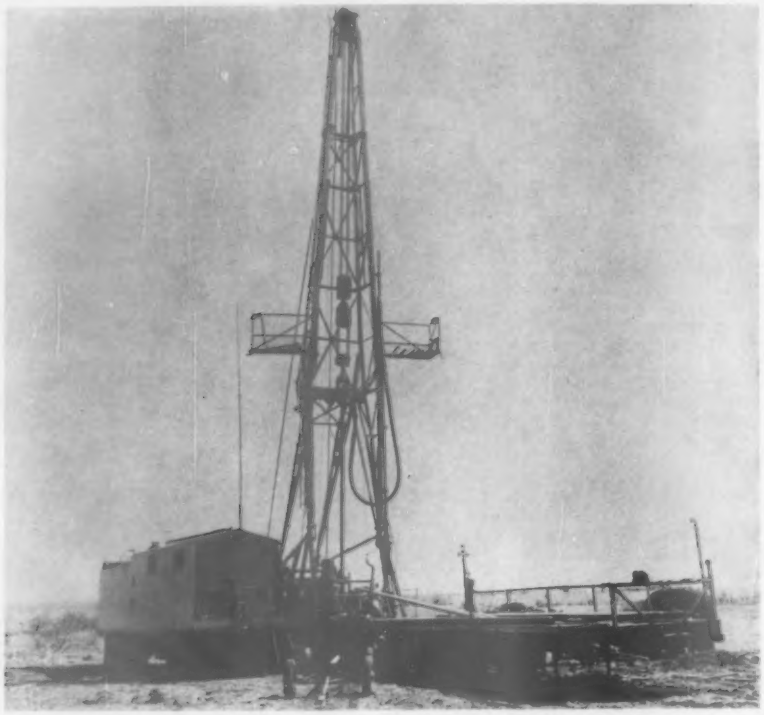


Slush Pumps 3000' to 25000' capacity Rigs



OVER-ALL VIEW of trailer-mounted National T-8 rig with 64-ft. mast.

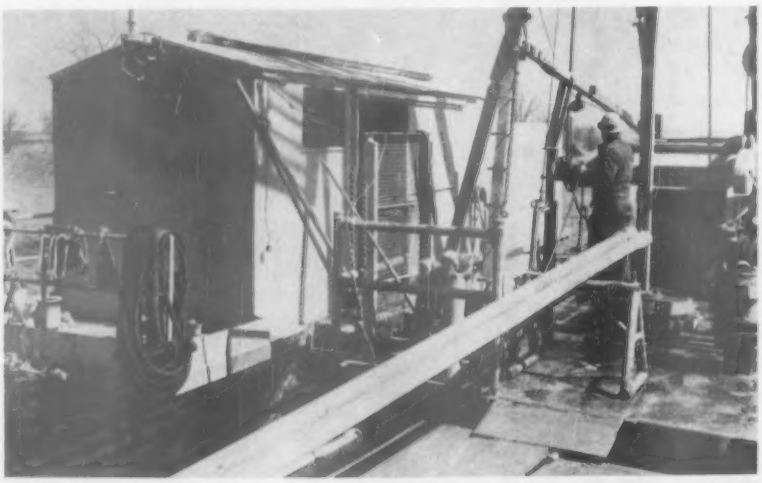
Hot rig does neat job

A FIRM that is gaining a reputation as the well-a-day driller is Deerfield Oil Corp., Chanute, Kans.

Using a trailer-mounted rig, the Deerfield crew has completed 21 wells that were drilled in 1 day each, including coring, and the move to another location. The wells average around 600 ft. deep.

In a 4-month period, the rig drilled about 50 wells, for a total of about 45,000 ft.

Built to the operator's own specifications, the rig consists of a Na-



SCENE on the floor of rig which drilled 21 consecutive wells in as many days, including coring and moving.

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500 TON
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ADDITIVE!

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tional T-8 draw works, mounted with the slush pump, rotary table, two engines, and a 64-ft. folding mast on a triple-axle trailer.

The draw works is powered by a General Motors 6V-71 diesel engine and the National D-50 slush pump by a General Motors 4031-C series 71 diesel engine. A National J-13 swivel is used. Lee C. Moore Corp. fabricated the mast and the trailer.

A substructure, 8 by 16 ft., which is transported separately, is set at the back of the rig, to form a floor and working area 16 ft. square.

Drill pipe and a 4-ft. laydown walk are carried on a double axle trailer, which is backed into place against the rig. A dog house, equipped with a diesel-burning forced-air heater, and diesel fuel and water tanks, are carried on another double-axle trailer.

The company operates about 1,000 shallow wells in the area. Frederick Martin and Stanley Rawn are vice presidents in charge of operations.

Storm map available

TWO MEN have devised a fine colored map which stirs the imagination and has a practical value for contractors, operators, owners of installations, and residents in the Gulf Coast and South Atlantic Seaboard.

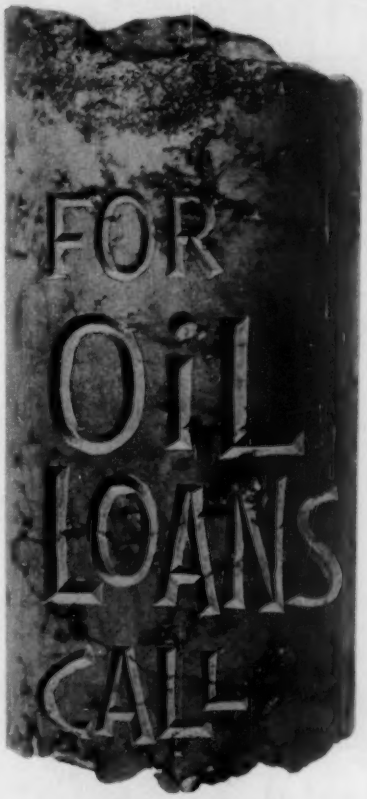
The chart is intended for specific plotting of the paths of new hurricanes and is called "Hurricane and Storm Track Map of the Gulf Coast."

Readily visible are the key cities of South U. S., those on the east coast of Mexico, the Yucatan Peninsula, and the islands of Cuba and Jamaica. Also shown are the vectors, landfall points, and dates of 111 hurricanes which have occurred from 1887 through 1957. A graph is included of the number of tropical storms reaching the mainland for each 5-year period between 1901-1955. The terms used in hurricane advisories are explained.

The graphic scale is approximately 1 in. equals 4.67 miles. On the border of the map are 5-minute divisions of latitude and longitude.

Further information of this map can be obtained from Copeland's, 826 Gravier St., New Orleans 12.

HARRY L. DEDMAN, Vice President, Petroleum Engineer, and Manager of Texas Bank's Oil Department.



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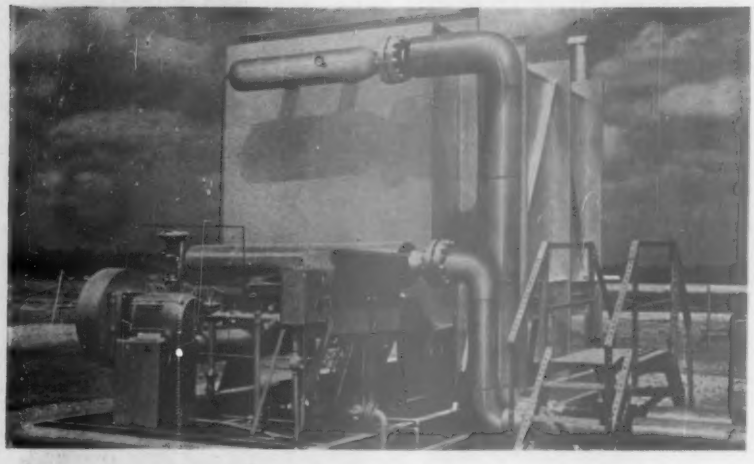
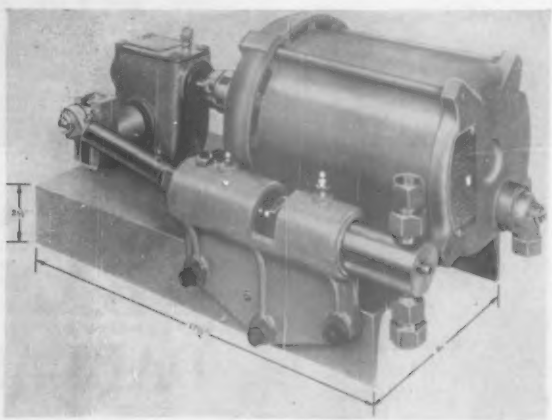


Efficient combustion, safety stressed in process heater

UNIFORM HEAT around the periphery of each tube and along each tube length is claimed to be achieved in a new heater for process use. This feature enables much higher heat flux rates without exceeding safe tube maximum metal-skin temperatures, compared with older heaters, the maker reports.

The new Uniflux heat exchanger is expected to prove valuable for a number of services. It can burn low-pressure fuel gas, including flare gas, with only a few inches of fuel pressure required. Gas-turbine exhaust gases can serve as combination air for atmosphere or pressure discharge.

A direct-fired fuel reactor provides instantaneous heat from ambient to 3,000° F. This reactor is a high-intensity mixer which permits rapid mixing of fuel and combustion air to give heat-release rate to 10 M.M. B.t.u. per hour per cu. ft. of combustion volume. A vortex created inside the reactor causes rapid recirculation of the reacting combustibles and combustion air. This recirculation feature acts as a flame holder and prevents flame blowout even if the mixture flame propagation velocity is exceeded. Incomplete combustion products are recirculated back into the reactor to complete combustion. Safety features of the heater include air purge and flame-failure safeguards and continuous pilots with electric-spark ignition. Source: **Black, Sivalls & Bryson, Inc.**, 7500 E. 12th, Kansas City 26, Mo., U.S.A.



Pump supplies fluid for liquid gravitometers

FLUID FROM lines operating under high pressure where no differential is available can be supplied to liquid gravitometers with one or two new pumps now being sold. The Model GSP-HP1 pump, a single-cylinder model, delivers from 0 to 2,000 cc. a minute at pressures to 1,000 psi.

Model GSP-HP2, a two-cylinder pump, delivers from 0 to 4,000 cc. a minute at pressures to 1,000 psi. A ⅓-hp. explosionproof motor powers both pumps, and both are constructed of stainless steel. Source: **Arcco Instrument Co., Inc.**, 7144 E. Condor, Los Angeles 22, Calif., U.S.A.

●

New tone multiplex equipment for data transmission, telemetering

A line of tone multiplex equipment suitable for wire-line, carrier, or microwave circuit use provides 24 tone channels between 420 and 3,180 cycles which can be keyed at speeds up to 100 words a minute.

Photographed at American Oil Co., (Wood River, Ill., Refinery)

New! A far more versatile hydrogen-treating catalyst

Are you still using conventional cobalt-molybdenum desulfurization catalysts on feedstocks high in nitrogen and polyaromatics? Then it will pay you (in production and profits) to investigate AERO® HDS-3 catalyst!

AERO HDS-3 is Cyanamid's brand-new nickel-molybdenum catalyst. Its biggest advantage is an unparalleled capacity for removing nitrogen and polyaromatics. In life tests, it markedly outperformed—and lasted longer than—conventional cobalt-molybdenum catalysts. It is also superior in sulphur-removal; in improving the color of waxes; in hydrogenation of feedstocks and middle distillates.

Behind this newest catalyst lies the experience of Cyanamid as a major producer of both catalysts and other chemicals. That experience is yours when you call your Cyanamid salesman—"The Man with the Golden Rule." Ask him—or write us—for the full data on AERO HDS-3.

Basic in catalyst chemistry

CYANAMID

AMERICAN CYANAMID COMPANY • REFINERY CHEMICALS DEPARTMENT • Bound Brook, New Jersey

Pioneer underwater crude storage tanks cut offshore crude storage and oil handling cost by approximately 50%

The world's first underwater storage tank which went into operation last year in the Gulf of Mexico near Eugene Island, has cut barge loading time to a mere 4 hours, with resultant savings in both operating and equipment costs.

The unit, which was floated into position and then submerged 30 feet, consists of tubular storage sections 209′ x 88′, cross sectional tubing and above surface plat-

World's first underwater storage tanks operated by Ocean Drilling & Exploration Company.

forms for working equipment and housing. Crude flows directly into the tanks from offshore wells.

Keys to the success of this revolutionary installation include maximum utilization of space and speedy transfer of stocks.

How Stocks Are Transferred

Two Johnston vertical barge stripper-type pumps are used to transfer crude stocks directly from storage to barge. Each has a capacity of 1200 gpm or approximately 41,000 bpd. The pumps also handle seawater when required as some of the tanks are used to keep it on the bottom.

Pumping Features

The barge stripper-type pump selected has characteristics which make it most suitable for a transfer operation of this type. (See Fig. 1.) A multi-stage turbine bowl assembly is combined with a single stage propeller for maximum suction lift without vapor lock. A vent line with manually operated valve primes the suction lines and strips the compartments to their lowest practical level. An equalizer line, running from the turbine bowl unit to a point immediately above the propeller unit insures against possible vapor lock of the turbine impellers. The pump primes itself at low fluid levels through the action of the propeller booster. The entire pump assembly can be lifted from position for maintenance or repair without disturbing piping because of in-line construction. Surface space requirements, of course, are at a minimum.

Johnstons have been working for experienced oil operators in many ways for more than 50 years—in refineries, pipe lines, water supply, secondary recovery—and now in offshore. A trained field man will be glad to give you complete information or show how Johnston can best serve in *your* operation. Just call or write for an appointment.

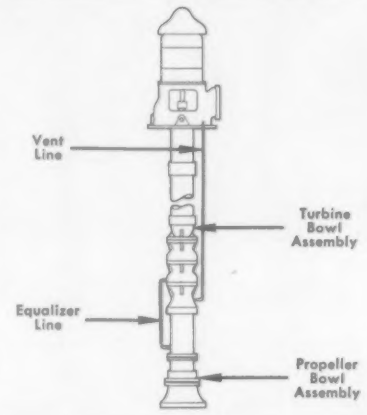


Fig. 1

JOHNSTON PUMP COMPANY

Main Factory: Pasadena, Calif., 3272 E. Foothill Blvd.; Phone: MU 1-7601

Factory Branches: New York 20, N.Y., 30 Rockefeller Plaza; Phone: PL 7-0431 • **Atlanta 1, Georgia,** 57 Forsyth St., N.W.; Phone: JA 3-7395 • **San Francisco 8, Calif.,** 260 Kearny St.; Phone: EX 2-0338 • **Roswell, N.M.,** 2007 S.E. Main; Phone: MA 2-5942 • **Pecos, Texas,** Balmorhea Highway; Phone: HI 5-3022 • **Idaho Falls, Idaho,** South Yellowstone Hwy.; Phone: JA 2-8144

It also provides 18 channels between 4,300 and 7,700 cycles which can be operated at signaling speeds up to 60 words a minute.

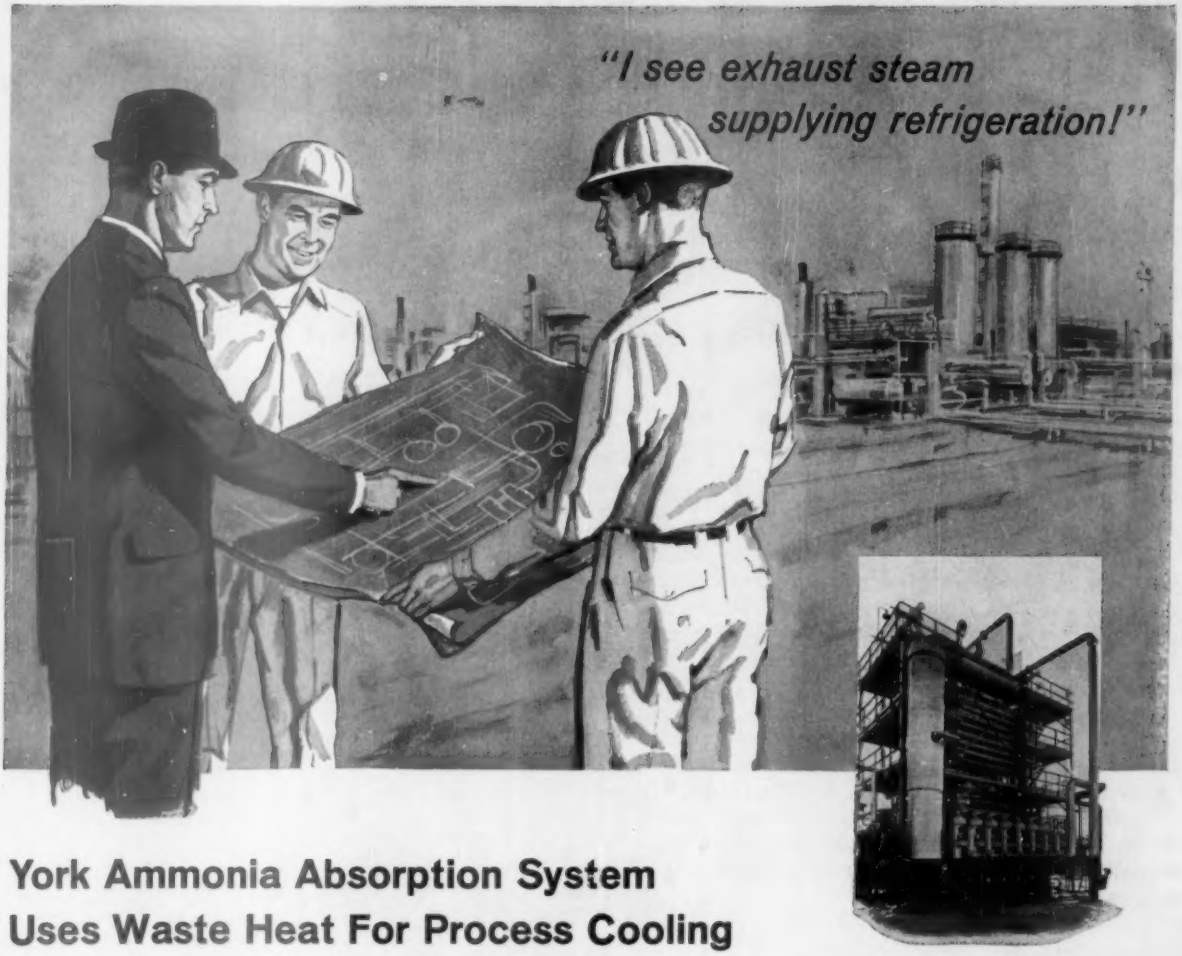
All types of terminations for telemetering, data transmission, and control applications are available for use with the Type CT-42 equipment. The basic circuitry is etched on glass-epoxy boards and forms a sandwich type of module with all parts readily accessible. Both transmitters and receivers are capable of frequency shift or on-off keyed operation without changing the circuit and without addition or substitution of submodules. Source: **Radio Corp. of America,** 30 Rockefeller Plaza, New York 20, N. Y., U.S.A.

•

Membrane filter offers help in testing water-flood injections

With a new membrane filter now on the market you can isolate any suspended material in the injection water for a water-flood unit. By noting the rate of filtration, as a function of the cumulative volume, you can obtain a curve which can serve as a characteristic index of the quality of the water and its ability to be injected into the subsurface formation.

Designed to resist corrosion, the filter holder is capable of withstanding pressures to 200 psi. It can be quickly taken apart and put together. Constructed entirely of lucite, with monel parts, the holder permits observation of the filter element during tests. The outlet ends are pipe-threaded. Source: **Custom Fabrication Corp.,** 2703 Dawson Rd., Tulsa 4, Okla.



York Ammonia Absorption System Uses Waste Heat For Process Cooling

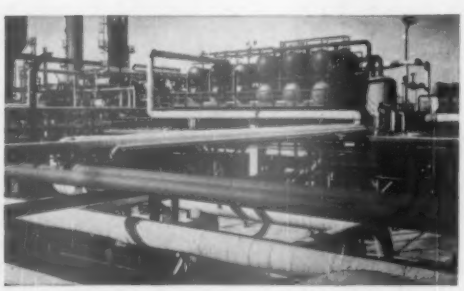
—Can operate unattended for long periods

VERY ECONOMICAL OPERATION—Utilizes exhaust steam from steam turbine driven equipment, hot oil, stack gases or waste heat from any source to provide refrigeration. Also can be direct-fired, if desired. York absorption units save substantially over conventional motor-driven compressor systems.

COMPLETELY AUTOMATIC—A few simple instruments control the system. These need no adjustment and are easily operated by average personnel. Flexible system operates from 100% to 0% capacity with almost constant efficiency, and is unaffected by sudden load changes and refrigerant "slop-over."

VIRTUALLY MAINTENANCE-FREE—Aqua ammonia pump is the only moving component in the entire system. This assures quiet, vibration-free operation and lowest possible maintenance. An extra aqua ammonia pump "spares" the system very economically and eliminates profit-cutting down-time.

INSTALLS OUTDOORS—Rugged construction eliminates need and expense of a building enclosure. Ideal for petro-chemical processing situations, or where indoor space is limited. Also adaptable for ammonia recovery. Capacities from 50 to 5,000 tons refrigeration for temperatures down to −90°F.



Another YORK Trail Blazer Concept Proved in Action at *Cities Service, Lake Charles, La.*—York Ammonia Absorption System uses waste heat from process vapors to deliver economical cooling at this Butadiene plant. Two-stage system provides 3,350 tons capacity—1,133 tons at 45° F. to cool spheroids and 2,217 tons at −5° F. for lean solvent cooling.

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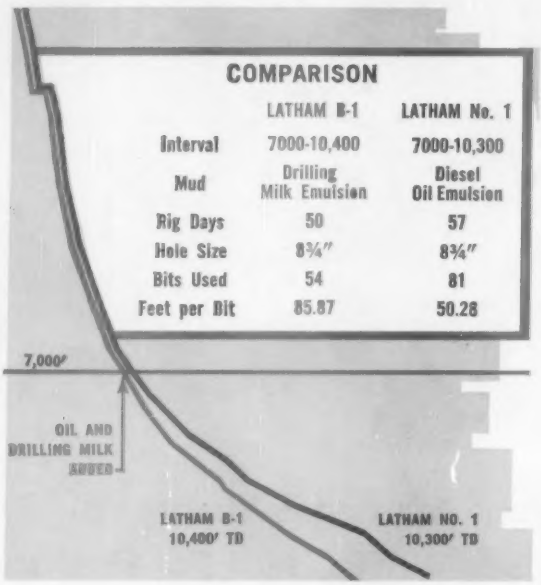
Fastest Drilled Well Used ATLAS EMULSIFIER

Shell Cuts Drilling Time in Bryan's Mill Field

In the Bryan's Mill Field, Cass County, Texas, a new record for the fastest drilled well was set by Shell Oil Company using an Atlas emulsifier. In drilling Latham B-1, seven days were cut from the previous field record, with a saving of $14,475 in rig time and bit cost.

An inspection of the drilling records for Shell's Latham B-1 and Latham No. 1, the previous fastest drilled well, shows the improvement was made in the interval where the Atlas emulsifier was used. The drilling contractor for the record well, Lecuno Oil Company, had almost identical drilling times and bit consumption from surface to 7,000 feet. At this depth the mud was converted to a low-solids emulsion using an Atlas emulsifier instead of a conventional emulsion mud. Comparing the last 3,300 feet, Latham B-1 was drilled in seven days less time and with 27 fewer bits. Translated into dollars, this represents a saving of $8,400 in rig time and $6,075 in bit cost.



Atlas emulsifier is sold through distributors under these tradenames . . . each is the product of Aquaness Department, Atlas Powder Company:

TRIMULSO®

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Registered trademark Baroid Division, National Lead Company

DRILLING MILK

Distributed by Magnet Cove Barium Corporation

Registered trademark Magnet Cove Barium Corporation

Drilling Milk
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MAGNET COVE BARIUM CORP. HOUSTON, TEXAS

ATLOSOL

Distributed by Milwhite Mud Sales Company and other selected mud companies

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ATLAS EMULSIFIERS IMPROVE A GOOD DRILLING FLUID
Because Atlas oil-in-water emulsion muds provide better oil action, they improve hole conditions, extend bit life, and increase penetration rates.

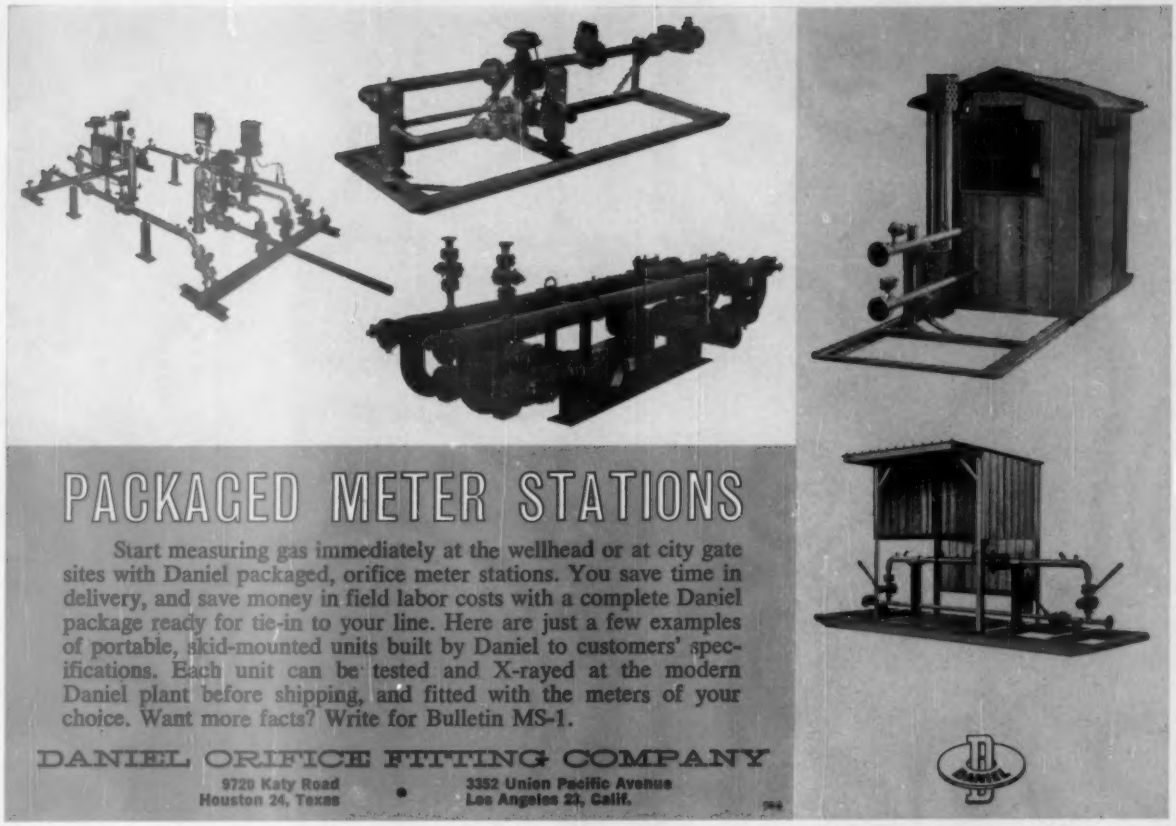
Better Hole Conditions. Atlas oil emulsion decreases torque as much as 50% . . . the hole is kept cleaner and pump pressures are correspondingly lower. There is less danger in lost-circulation and low-pressure zones.

Longer Bit Life. Atlas oil emulsion prevents balling, provides better cutter and bearing lubrication. Greatly extended bit life reduces bit costs, reduces rig hours lost to trip time.

Faster Drilling Rates. Atlas oil emulsion makes more feet of hole per hour. Oil lubrication combines with improved hole condition to increase drilling rates in competent and troublesome formations.

ATLAS Aquaness CHEMICALS ATLAS POWDER COMPANY

Aquaness Department, Atlas Powder Company
P. O. Box 21072 • Houston 26, Texas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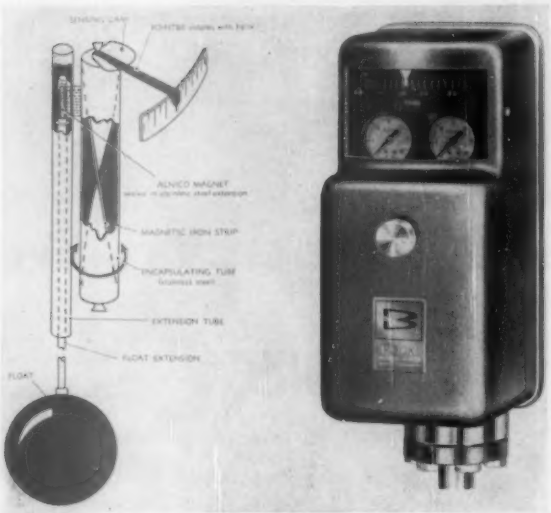


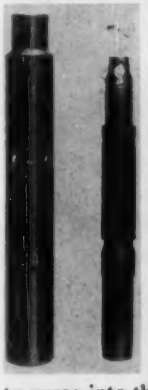
Level control instruments for corrosive service

INDICATION, alarm, and control can be provided for corrosive fluids at pressures to 40,000 psi. with a line of instruments recently brought out. They come in a variety of materials and with buoyant and displacer floats for liquid level, interface-level, or specific-gravity uses.

An outstanding feature is a magnetic position converter that permits the instruments to provide any or all of the functions of indication, alarm, and on-off control in one instrument. The position converter is a transducer that consists of a float extension containing a magnet and a magnetic iron helix enclosed in a nonmagnetic stainless-steel tube. The magnet imbedded in the float extension attracts the leading edge of the helix. As the float and extension move up or down, the magnetic attraction makes the helix rotate. An indicating pointer and sensing cam attached to the helix rotate with it. The sensing cam works through a pneumatic follower or differential transformer to transmit level measurements. Source: **Brooks Instrument Co., Inc.,** Hatfield, Pa., U.S.A.

●

Formation sand removal



Sand can be surged from formations into the casing where it can be handled in routine well cleanout with a shock valve now available. The tool operates through the instantaneous shifting of a full-bore valve from a completely closed to a completely open position. This allows formation pressure to surge into the drill pipe or tubing.

When the shock valve is being run into the hole, an aluminum disk

Project: 325,000 kw power plant for Arkansas Power & Light Company. Prime Contractor: Ebasco Services Inc. Sub-Contractor: Grafe-Weeks Corporation. Electrodes: Airco.

AIRCO LOW HYDROGEN ELECTRODES USED ON HIGH TENSILE PIPE WELDING *at giant new power station*

AIRCO LOW HYDROGEN ELECTRODES were used by Grafe-Weeks Corporation to weld the hundreds of feet of high pressure piping in the giant new steam turbine power plant of the Arkansas Power and Light Company at Helena on the Mississippi.

Why? . . . Because Airco low hydrogen electrodes provide an easily directed arc specifically designed to meet requirements of high pressure pipe welding . . . They also deliver X-ray quality deposits under tough conditions.

Ask for a shop demonstration. Would you like to see Airco electrodes put to the test? Let your Airco salesman or distributor arrange a demonstration at your convenience . . . using Airco low hydrogen electrodes or any other group of Airco electrodes. Call Airco, or look in your Classified Telephone Directory under "Welding Equipment and Supplies" for your nearest Authorized Airco Distributor.

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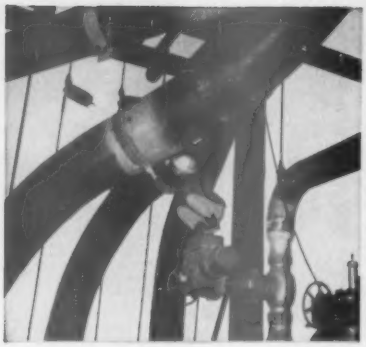

For your low hydrogen welding— Airco electrodes meet every critical need

Here are the Airco low hydrogen headliners — from a total of more than 100 Airco electrode types in more than 400 sizes and designs —

AIRCO 312 AWS-ASTM E60-7016. For welding higher strength alloy or carbon steels. Also high sulfur content steels. Designed to overcome "underbead cracking." Lessens need for high preheat or stress-relieving postheat.

AIRCO 396 AWS-ASTM E8016-C1. For welding the 2½% to 3½% nickel steels used in low temperature jobs. Also for nickel bearing steels, to provide uniform chemistry at joints with minimum difficulty. No high preheat needed.

AIRCO 395 AWS-ASTM E8016-C3, A 1% nickel type of low hydrogen electrode. Also for nickel bearing steels where good low temperature properties can be attained; high sulfur content steels; grade HT and similar high tensiles.

AIRCO 394 AWS-ASTM E10016-D2. For welding manganese-molybdenum high strength steels such as A-302 Grade B.

AIRCO 354 AWS-ASTM E8016-B2. For welding 1.25% chrome 0.5% molybdenum steels used for pressure vessels in high temperature service; and for castings of similar analysis.

NOW — "Barrier Carton" bars moisture damage. Special aluminum foil interlining in new carton now protects dryness of Airco low hydrogen electrodes *8 times better than regular style carton.* If your application can't tolerate moisture damage...specify Airco.

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across the valve bore keeps well fluids from entering the drill pipe. The valve is disconnected at the same time as the packer. As the driller puts weight on the packer, a special mandrel breaks the aluminum disk. This opens the shock valve instantly and lets formation pressure surge into the drill pipe or tubing. This surge of pressure forces sand into the casing and up into the drill pipe or tubing. It can then be washed from the casing in the usual manner. Source: **Johnston Testers, Inc.,** Box 98, Houston 1, Tex., U.S.A.

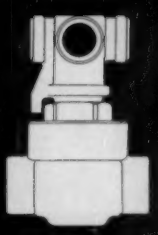
•

New type of engine

An orbital principle has been conceived and applied to the design of internal-combustion engines. The result is a piston type of engine that has only rotational movement—no reciprocating movement as in the conventional type of piston engine. According to the developer, the engine, called the Selwood Orbital engine, has no conventional type of cranckshaft or connecting rods. The engine's mass itself is used instead of a flywheel.

The engine operates on a two-stroke cycle. Ignition is brought about by conventional spark plug. Cooling is by forced convection from the finned surface of the rotating part of the engine.

As described by the developer, the engine has six cylinders whose centers are spaced equally around a circle. In these cylinders, six double-ended curved pistons slide without reciprocation. The centers of the pistons are the ends of the arms of a spider mounted on ball bearings at an angle to a central stationary shaft. The pistons have



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Consider too, the extra quality points of the light-weight TEXSEAL, such as compact size, round port, preloaded plug (for easy operation), bubble-tight sealing, free-floating, self-aligning, replaceable seats, in-the-line repair and temperature compensation.

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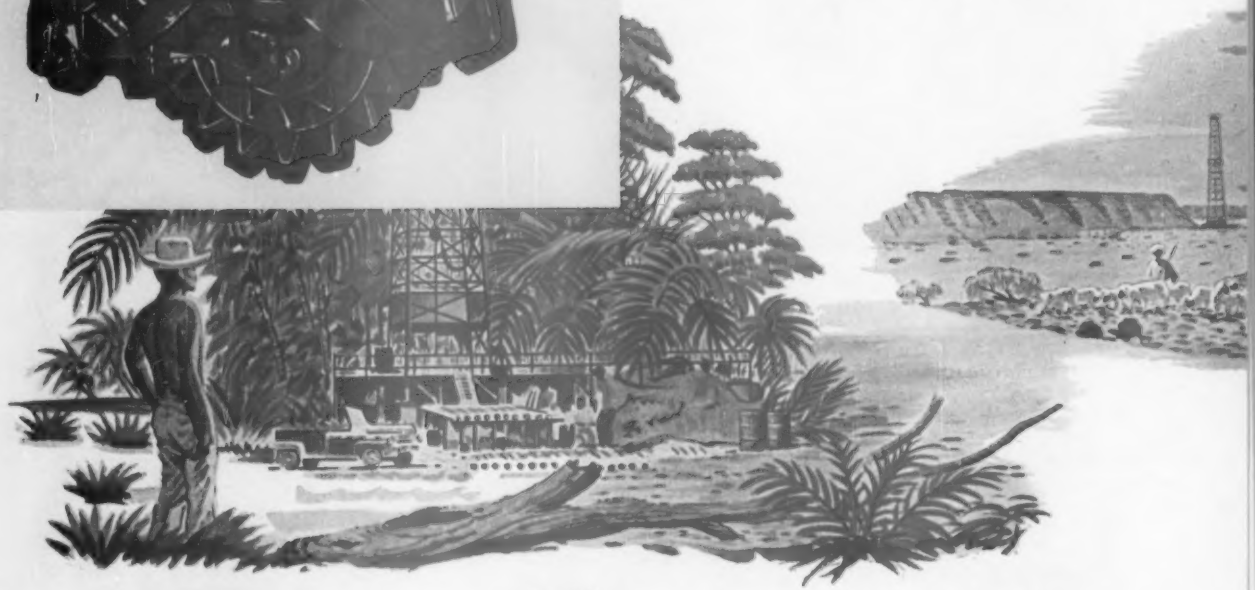

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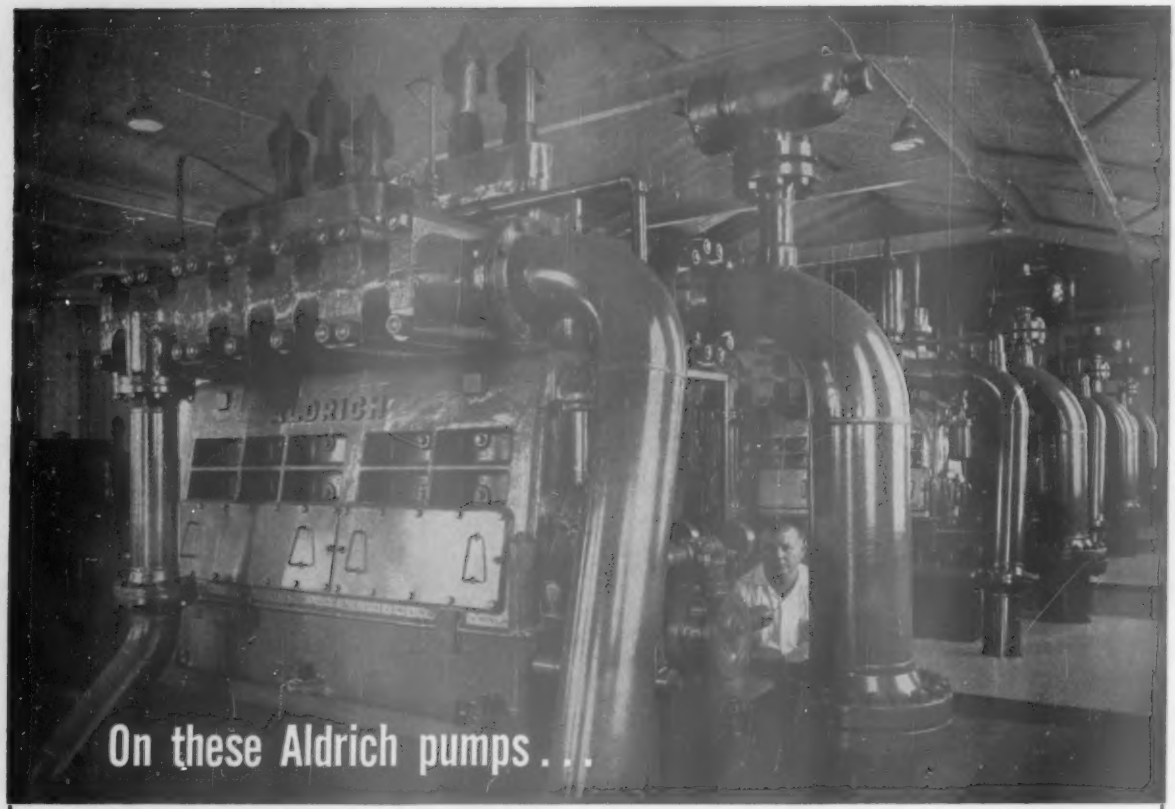

GULF OIL REPORTS 6 YEARS OF CONTINUOUS SERVICE WITH MINIMUM MAINTENANCE

FIELD REPORT

FLOOD: Goldsmith-San Andres Unit
OPERATOR: Gulf Oil Corporation
PUMPS: 4 Aldrich Quintuplex
FLOODING STARTED: October, 1954
EXPERIENCE TO DATE:

After six years, three pumps operate 24 hours a day, delivering some 54,000 bbl/day of sour oil field brine at 750 to 800 psi. Station designed for automatic operation. All maintenance handled by one man during eight-hour work day.

Field Parts stock available in Houston, Odessa, Alice and Wichita Falls, Texas; Casper, Wyo.; Hobbs, N.M.; Carmi, Ill.; Charleston, W. Va., Tulsa, Okla.; Los Angeles, Calif.; Calgary, Ontario. For further information write the ALDRICH PUMP COMPANY, 9 Gordon Street, Allentown, Pa.

the tough pumping problems go to ALDRICH

. . . one of a series presented by Western Supply Company, Tulsa, to improve the "I.Q." of engineers . . .

MANAGEMENT STATUS: DREAM OR MIRAGE? TECHNOLOGY AN ASSET, OTHER TRAINING NEEDED

The complexity of modern industry has created a great demand for management personnel with engineering training. Surprisingly, there is a very short supply of such men, i.e., engineers with enough potential to be groomed for executive functions.

Historically, as big industry moved out of restricted, private ownership into broader public ownership, two things happened, both of which added to the demand for "management men." First, public ownership made possible more diversified management, as opposed to the centralized control characteristic of family ownership. Second, the complications and diversification of modern industry have sharply increased the ratio of executives to employees. Where the ratio was formerly approximately one executive to 100 employees, it is now more like one to 35.

Recognizing that employment has increased by about one-third during the same period, the need for management personnel becomes clearer. Not only do few engineers graduate from school ready to be managers, few of us study courses as undergraduates which would prepare us for executive leadership later in our careers. Finally, as a prerequisite for managing the affairs of others, there is no substitute for experience.

WHAT DO YOU REALLY WANT?

If you are facing this important decision in your present status, get your future into focus before taking the step. Decide what you really want from your personal and business careers. It is sometimes too easily assumed that all men want to move on to higher, executive positions. With few exceptions, all men pay lip service to "wanting to get ahead," but too many of us hoodwink ourselves into believing this means management responsibilities, without fully recognizing the significance of such a step.

As a matter of fact, all men *don't* want to advance into management. Some, however, find this out too late, for unless they are psychologically and emotionally suited for the rigors of management, the driving ambition to assume more leadership, responsibility and authority may not in itself be a worthwhile goal. If a man is doing well where he is, it may be a mistake for him to try to move into the management orbit, for the move to management is not the only door to advancement.

FOOTNOTE: These are only the first few paragraphs of Western's latest "professional advancement" series, Booklet E-9. Titled "Engineering-Management Status: Dream or Mirage?" your copy is free upon request. Write to Western Supply Company, Heat Exchanger Division, P. O. Box 1888, Tulsa, Okla. — where your advancement is to our benefit and where the right decisions produce quality-design heat exchangers.

motion relative to the cylinder bores, but do not actually reciprocate. They follow a circular path. Source: **Wm. R. Selwood, Ltd.,** Chandler's Ford, Southampton, England.

●

Surveying is fast with new electronic instrument

A product called the DM-20 Electrotape offers a precision electronic distance-measuring method for such jobs as surveying and mapping pipeline routes and other projects. The device provides direct readout of distance in digital form. It will measure line-of-sight distances ranging from 30 ft. to 30 miles with an accuracy of 0.03 ft., plus 3 parts per 1,000,000, the maker claims.

The measuring system consists of two tripod-mounted instruments placed at opposite ends of a base line to be measured. The instruments are identical. Either one can be used as the interrogator or responder. This lets you take measurements from each end of the baseline to immediately check the distance obtained.

Essentially, the instrument measures the time it takes for a radio wave to travel from one unit to the other and back again. Each instrument is completely self-contained and includes a built-in antenna-reflector, power supply and radio telephone. Readout appears as numbers on a counter, directly in centimeters. The instrument can be operated at temperatures from −40° to 125° F. Source: **Cubic Corp.,** 5575 Kearny Villa Rd., San Diego 11, Calif., U.S.A.

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Solve down-hole pump problems by standardizing on Thompson Rod Pumps—they run longer, more economically. You can count on reliable performance!

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STANDARD:
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1 1/4" 2"
1 1/2" 2 1/2"

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DRAWER 591 • OKMULGEE, OKLA.

Trap prevents steam loss

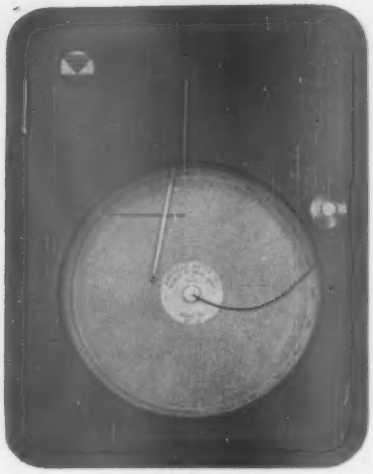
A new thermostatic steam trap is now on the market for pressures from vacuum to 150 psig. and temperatures to 425° F. which features a baffle that deflects live steam upward to envelop the bellows and cause a fast snap-closed action to prevent steam loss.

The trap comes in ½ and ¾-in. sizes and operates on a balanced-pressure principle. Features include a cast-steel body, forged-steel cover, monel bellows, and a stainless-steel valve and seat. The valve and seat are lapped for tight shutoff. The Model N-150 trap can be installed horizontally or vertically. It can be inspected without breaking line connections. Source: **W. H. Nicholson & Co.,** 12 Oregon, Wilkes-Barre, Pa., U.S.A.

Polisher for core samples

Fine lapping and polishing of petrographic ore samples can be done with a new product now available, the Uni-Pol polisher-grinder. Features include an 80 to 1,200-r.p.m. variable-speed control and a ½-hp. d.c. motor that gives a constant torque. Vibration and rollout are virtually eliminated, the maker claims.

The pan, lap, polishing wheel, and cover can be changed as a unit without danger of contamination. Source: **Geoscience Instruments Corp.,** 142 Maiden Lane, New York 38, N. Y., U.S.A.



AMERICAN®
PRESSURE and TEMPERATURE RECORDERS

American® single and two-pen *Pressure Recorders* for pressures from 30 inches vacuum to 10,000 psi.

- Pressure elements individually calibrated over full range.
- Variety of chart drives available.
- Helical elements of different ranges are interchangeable.
- Stainless steel pen arms with span and linearity adjustments.
- Aluminum dust and moisture-proof case.

American® *Temperature Recorders* for an accurate record of flowing temperatures.

- No ambient temperature errors.
- High sensitivity and torque—fast speed of response.
- Standard 0-150°F. range. Other ranges available by request.
- 24-hour mechanical or 110-v. 60-cy. electric chart drives.

Ask for Bulletins 400 and 408

AMERICAN®
METER COMPANY
INCORPORATED (ESTABLISHED 1836)
General Offices: Philadelphia 16, Pa.
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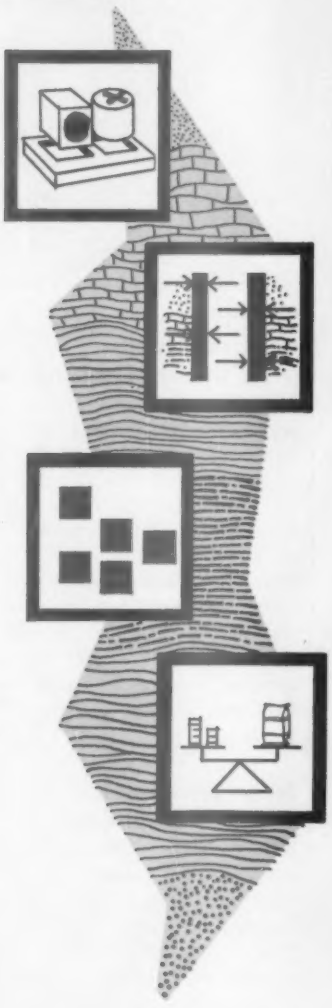
MUD WEIGHTING MATERIALS MAY LOOK ALIKE... BUT TESTS SHOW

BAROID* PERFORMS BETTER



All barium sulfate mud weighting materials look and weigh about the same, but they perform differently. Each mud company sets its own standards of quality. BAROID sets the highest standards.

These differences in standards can mean added expense to control the three basic properties of drilling mud: weight, filtration and flow properties.

One brand of weighting material may give your mud twice or three times as much gel strength, viscosity or filtrate loss as another brand. WHY TAKE CHANCES? *Use* BAROID, *the winner in performance!*

BAROID

BAROID DIVISION NATIONAL LEAD COMPANY

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

BAROID—*Still Pioneering Drilling Mud Research • Engineering • Marketing*

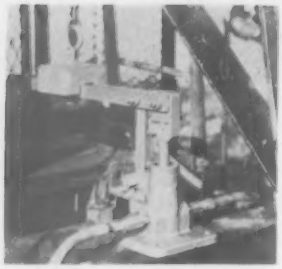
*Registered Trademark, Baroid Division National Lead Company

6110

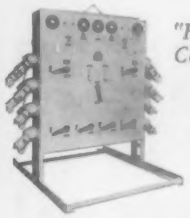
Newest in chemical pumps for injecting solutions into wells

From 5 to 150 gal. daily of treatment solution can be injected into the casing head or flow line of pumping wells to prevent corrosion, scale, or paraffin problems with a new chemical pump which has been brought out. Once the pump is set to the desired flow rate, the flow of treatment solution is constant.

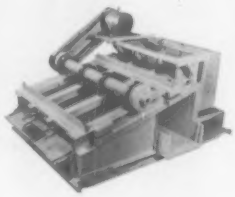
The maker says the pump is built to high-pressure hydraulic standards and will safely withstand working pressures up to 1,000 psi. Source: **Pacific Perforating Co., Inc.**, P. O. Box 144, Torrance, Calif., U.S.A.



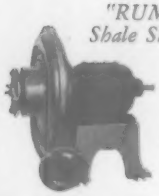
"Floodlights"



"Floodlight" Generator Control Panels

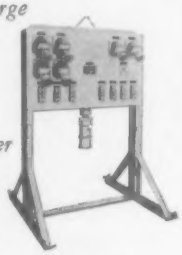


"RUMBA" Shale Shaker

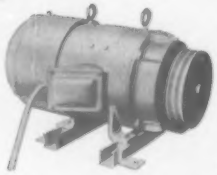


"Floair" Forge Blowers

IT'S OUR PRACTICE TO MANUFACTURE THE FINEST EQUIPMENT AVAILABLE. THAT'S WHY YOU'LL FIND THESE HUTCHISON PRODUCTS IN USE ALL OVER THE WORLD!

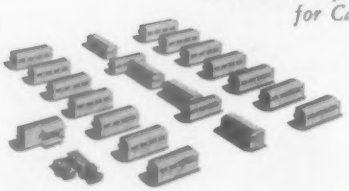


"Floodlight" Power Distribution Panels



Electric Motors and Motor Controls

"Floodlight" Power Distribution Systems for Camps



"Floodlight" Derrick Lighting Systems

HUTCHISON
MANUFACTURING COMPANY
P. O. BOX 9335 • HOUSTON 11, TEXAS

A SUBSIDIARY OF REVERE ELECTRIC MANUFACTURING CO.

Hard bearing surface resists wear on latest polished rods, liners

An alloy powder of finely divided boride, carbide, and nickel particles is heated and sprayed onto the base metal of a new line of polished rods, rod liners, and sucker-rod couplings. The material is then fused under extremely high temperature to form a homogeneous bond with the steel. The part is then finish-ground to a smooth bearing surface.

The couplings are made for sucker rod sizes from ⅜ to 1 in. The polished rods come in lengths from 8 to 22 ft. for rod sizes from 1⅛ to 1½ in. The polished-rod liners are available in lengths from 36 to 96 in. for rod sizes from 1⅛ to 1½ in. Source: **Harbison-Fischer Mfg. Co.**, P. O. Box 2477, Fort Worth, Tex., U.S.A.

•

Seven driver parts in socket set give many combinations

Equipment repair in the field or plant may be speeded with a new socket set recently brought out as its seven basic driver parts permit the repairman to make hundreds of different drive combinations to get at various sections of equipment. These drive combinations can range from a flexible ratchet head to a sliding T-bar. The 11 socket sizes range from ⅜ to 1 in., by sixteenths. Source: **J. H. Williams & Co.**, 400 Vulcan, Buffalo 7, N. Y., U.S.A.

•

New cleaner for wells, equipment

A granular mixture of solid acid, corrosion inhibitors, and demulsifiers promises a solution to scale removal in producing wells, injection wells, filters, heater treaters, pumps, and pipelines.

No special storage is needed. The product creates no danger of fire, toxic fumes, or explosion, the maker says. Source: **Hagan Chemicals & Controls, Inc., Oilfield Div.**, Hagan Center, Pittsburgh 30, Pa., U.S.A.

electron micrograph shows why Slick Water reduces pumping horsepower losses during well treatments

This electron micrograph shows an 11,000-time magnification of the polymer in Slick Water*, Dowell's friction-reducing agent for water. Agents providing a similar effect are also available for oil and acid. ☐ Notice the structure of the polymer. It is believed that the polymer confers an elastic behavior which suppresses the usual turbulence of fast-flowing fluids. This action saves much of the energy lost by random turbulent motion and reduces friction in the pipe.

This means lower fluid friction and greater pumping efficiency

What can Slick Water do for you? It all depends on your well and your treatment requirements.

In some cases, it means that you may need only one pump truck instead of three for fracturing or acidizing. You pocket the saving!

In some cases, it may mean that you can get the benefits of high-injection-rate fracturing without having to pull tubing.

In other cases, it may mean that you can attain desired injection rates, yet stay within the pressure limit set by the strength of the casing.

In still other instances, it may mean that you can perform larger, higher-rate treatments and profit from bigger production increases.

And sometimes, it may mean that you can use a lower cost fluid – again reducing treatment costs.

Dowell friction-reducing agents have helped operators get lower treatment costs and greater production increases. Ask your Dowell representative for more information. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela, Argentina, Germany, France and the Sahara area. Dowell, Tulsa 1, Oklahoma. *DOWELL TRADEMARK

SERVICES FOR THE OIL & GAS INDUSTRY

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S. E. HUEY & CO.

ENGINEERS & SURVEYORS

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SURVEYING & MAPPING

PIPE LINE SURVEYS

What's NEW

. . . in literature

Aluminum, welded-steel grating

Two separate bulletins (12 and 4 pages) are now being offered free. They show electronically welded grating said to offer special safety features. The publications contain safe-load tables, panel-width specifications, weight tables, conversion factors, plus applications. Source: **Kerrigan Iron Works Co.,** Eleventh and Herman St., Nashville 2, Tenn., U.S.A.

Extreme-pressure equipment

This new catalog shows precision proportioning and hydrostatic pumps, compressors, check and stop valves, process and tubing fittings, high-pressure vessels, and process-gas filters, with specifications. Source: **McCartney Mfg. Corp.,** 601 W. 12th St., Baxter Springs, Kans., U.S. A.

New proportioning pump

Bulletin A10 describes this pump designed for metering, sampling, treating, and injecting applications by chemical, petrochemical, and water-treating plants; refineries and pipelines. The pump is available in both simplex and duplex models. Source: **Afton Engineering Co.,** Box 9426, Houston, Tex., U.S.A.

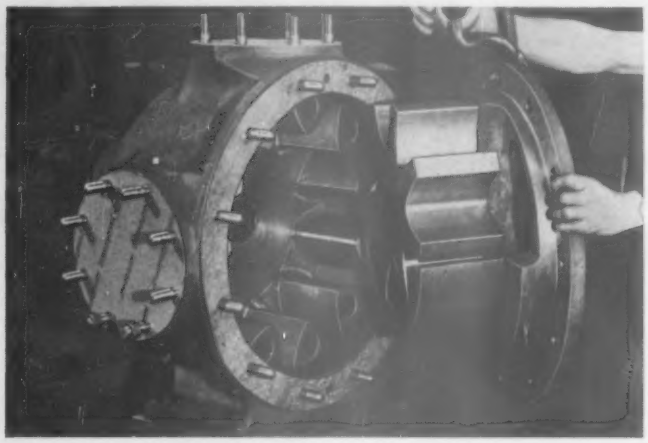
Gas-density detectors

In four pages, Bulletin 461 describes the detectors' principle of operation and includes a schematic drawing with a nomenclature table. The literature piece offers photographs and gas-density detector and power-supply specifications. Source: **Gow-Mac Instrument Co.,** 100 Kings Rd., Madison, N. J., U.S.A.

Tank-suction heaters

Bulletin 60-J1 covers design and operating characteristics available for either intermittent or continuous removal of highly viscous fluids from tank storage. Fluids include No. 6 fuel oil, asphalts, and lube-oil stocks. The literature piece explains how the units may be applied

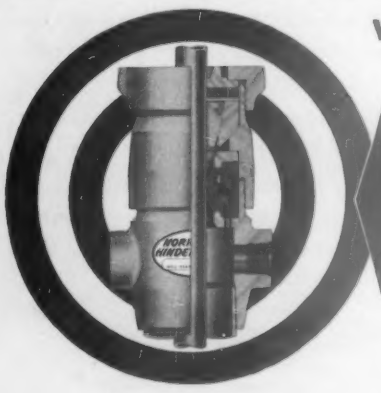
GEARED TO HANDLE PUMPING PROBLEMS



THE VIKING "GEAR-WITHIN-A-GEAR" PUMPING PRINCIPLE helps engineers solve a wide range of pumping problems throughout the world. In the petroleum industry, chemical processing, food processing, meat packing, road building and many other industries, **VIKING PUMPS** handle liquids and semi-solids efficiently and at low cost. And **VIKINGS** pump liquids ranging from thin, liquefied gas to thick, viscous tars. Originated 50 years ago, the **VIKING** pumping principle has been adapted so successfully to so many applications that **VIKING** is now the largest exclusive rotary pump manufacturer in the world.

You men who specify and buy rotary pumps, can select from a complete size range of **VIKING PUMPS,** from ½ to 1050 G.P.M. in over 850 catalogued models and thousands of special designs. If you have a pumping problem, tell us . . . and ask for catalog 61ST.

VIKING PUMP COMPANY, Cedar Falls, Iowa, U.S.A. In Canada, it's **"Roto-King"** Pumps. **Offices and Distributors in Principal Cities. See Your Classified Telephone Directory.**



W. C. NORRIS

Target

ECONOMY • SERVICE • SAFETY

WRITE FOR NEW WELL HEAD BULLETIN P. O. BOX 1739, TULSA

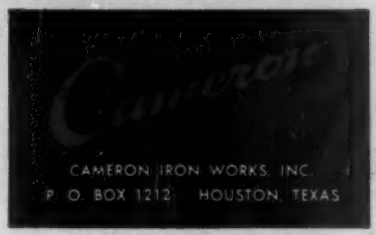
TUBING & CASING HEADS

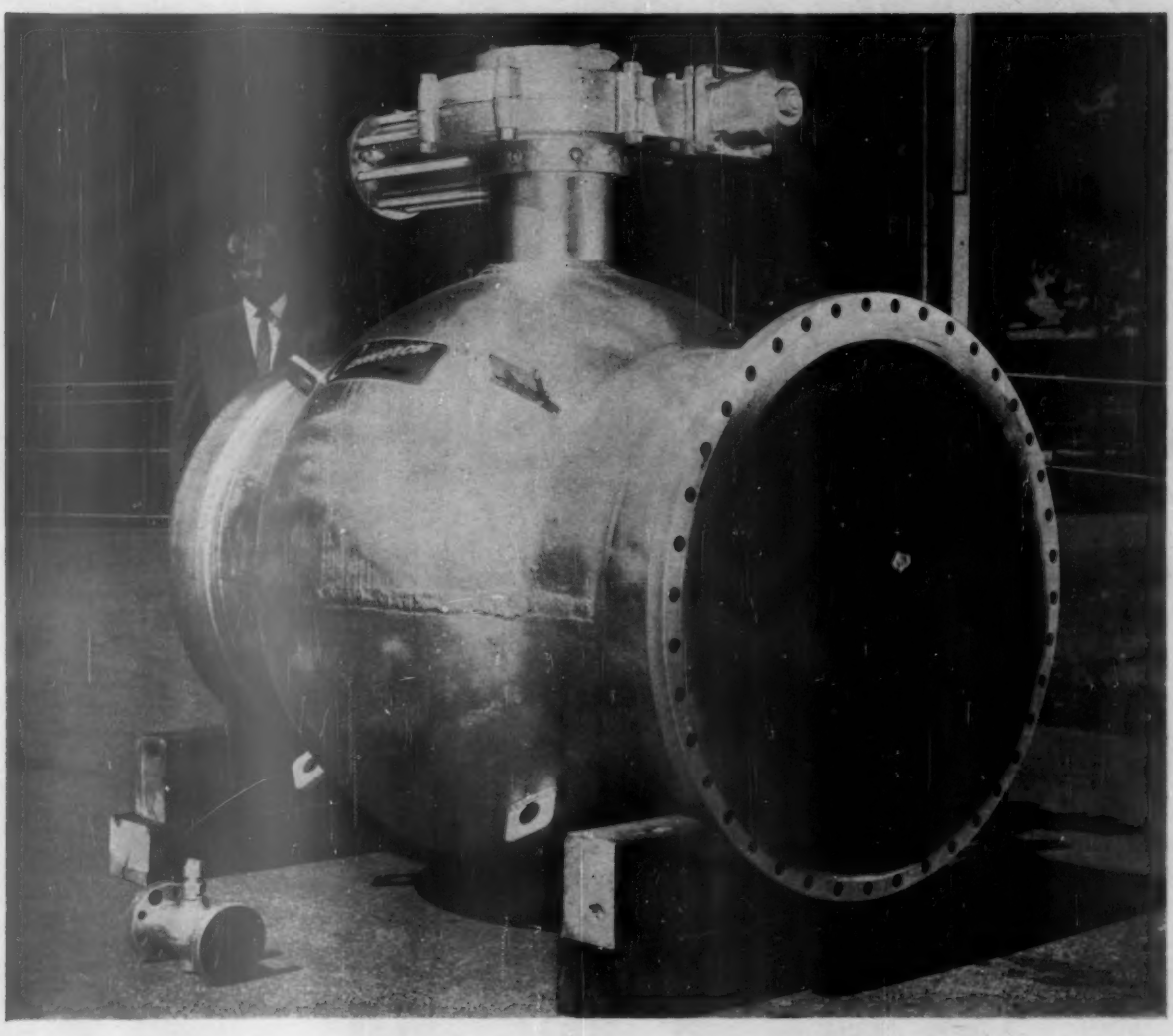
PERFORMANCE AND ACCEPTANCE

Repeat orders roll in for Cameron Ball Valves. Enthusiastic reports from test installations during the past three years show performance justifying every claim.

The reasons for this enthusiastic acceptance are plain – simplicity, with a minimum of parts – no bonnets or glands to leak – no lubrication for bearings or seal – easy to operate with Teflon bearings – tight shut-off indefinitely, with rotating seats – sealed for life, no maintenance.

Plan now to profit from the trouble-free operation and lack of maintenance expense of Cameron Ball Valves.

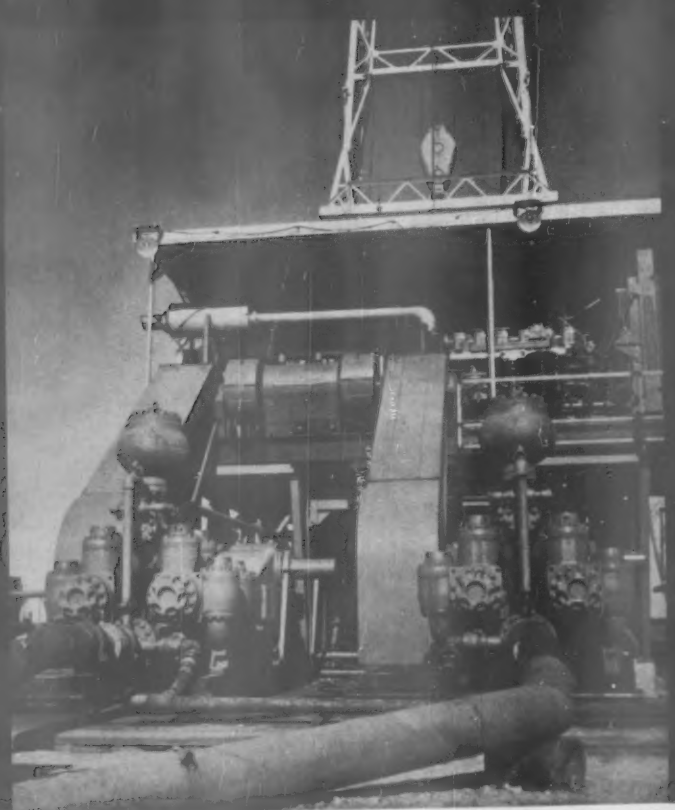




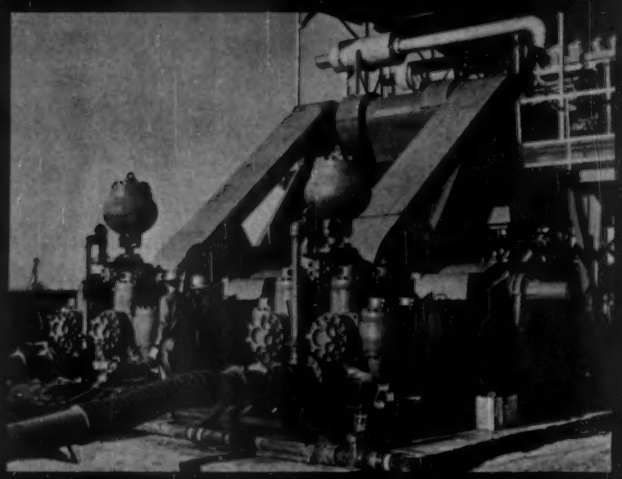
CAMERON BALL VALVES

Available in sizes 2″ through 42″

Ask J&L Supply about . .



J&L SUPPLY



. . Gardner-Denver pumps
Gardner-Denver parts
Gardner-Denver service

Drilling crews often find their nearest neighbors to be jack rabbits, coyotes and sidewinders. At night their rig lights may be the only sign of human activity for fifty miles.

Dependable equipment is essential. So more and more drilling contractors have standardized on Gardner-Denver mud pumps.

When service is required, the Gardner-Denver pump can generally be repaired in the field with parts quickly available from a local J&L Supply store.

And it's wise to insist on genuine Gardner-Denver parts to put a pump in like-new condition.

Complete information on any Gardner-Denver pump is available from your local J&L Supply man, or from our Tulsa office, 1437 South Sheridan Road, Tulsa.

Jones & Laughlin Supply Division « Tulsa

SOUR GAS?

Use a SWECO Sweetener for H_2S removal. Ideal for analyses under 50 grains per hundred cubic feet. Will clean to .01 grain per CCF. No pumps, no water, no towers, no boilers, no power required. Low initial cost. Low maintenance. Ideal for well site installation. One day to install.

SWECO

Southwest Equipment Co.

Prudential Bldg. Houston 25, Texas
Phones JA 2-5444 OR 4-8484

in either above or belowground tanks. Capacity tables for various heating ranges are included, together with dimensions and weights. Source: **Davis Engineering Div., Tube Reducing Corp.,** Box 959, Passaic, N. J., U.S.A.

Three wheel-type and three track-type Traxcavators

This new eight-page booklet shows several applications that can be handled by front-end loaders. Entitled "Do More Jobs . . . Easier," the literature pictures each machine under actual working conditions. Accompanying copy explains what uses the machine fits best, and what machine features qualify it for this particular application. Included are photographs of attachments and condensed specifications. Source: **Caterpillar Tractor Co.,** 600 W. Washington St., Peoria, Ill., U.S.A.

Piston pipe prover systems for meter calibration

Featured in this four-page literature are Halmor liquid-meter prover systems which permit positive-displacement meters to be proved within a few minutes and which are said to eliminate start and stop errors. Designed to prove crude, products, and LPG meters, the instrument is available in models to handle meters of all sizes at working pressures up to 1,200 psi. and flow rates to meet all requirements. Source: **J. A. Halpine & Son, Inc.,** Box 6147, Tulsa 17, Okla., U.S.A.

New brochure discusses hardfacing electrodes, wires

A crossreferenced, pictorial layout—in which all hardfacing materials are classified and illustrated according to use—makes it convenient to find information in this publication. Form ADC 955 details wear protection provided on industrial and construction equipment by hardfacing alloys. A description of each electrode is presented along with application data. Listed are over 100 specific equipment parts that benefit from hardfacing, together with the type of wear to which each is subject, and the alloy needed to protect it. Source: **Air Reduction Sales Co.,** 150 E. 42nd St., New York 17, N. Y., U.S.A.

KOPPERS *ON-THE-SPOT AVAILABILITY OF RINGS KEEPS YOUR LINES "ON STREAM"*

Dependable performance in all oil and gas applications

Koppers Piston Rings are now available in the field in a complete range of materials and a wide selection of types and sizes for every application in the oil and gas industry

For trouble-free performance, lower operating costs, less down-time, select Koppers Piston Rings—choice of many original equipment manufacturers.

Koppers Piston Ring dependability, in even the most rugged applications, is backed with 38 years of experience in manufacturing rings of predictable performance.

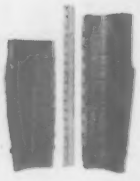
If you have a ring problem, consult your Koppers field agent or write: KOPPERS COMPANY, INC., Piston and Sealing Ring Department, 6607 Scott Street, Baltimore 3, Maryland.

Send now for Koppers recommended Piston Ring Set-Ups applicable to the engines which you operate.

KOPPERS

AMERICAN HAMMERED INDUSTRIAL PISTON RINGS

Engineered Products Sold with *Service*



KelCo's Standard and Long Dies Give More Pipe Contact

KELCO

POWER CASING SLIPS

Famous KelCo features make these air-operated casing slips a necessity for safe, efficient pipe running. Slips are raised and lowered by dual air cylinders. Protects casing, saves time, makes you money. For 4½" through 7" casing.

Available Through Your Preferred Supply Store

Write For Free Catalog And Price List

Cathead Power Slips Tubing Tongs

BE SAFETY WISE KELCO KELCO

BEN F. KELLEY CO., INC.
18 South Madison
TULSA, OKLAHOMA

NEW CHIKSAN SPRING BALANCED LOADING ARM—

Here is a series of loading arms that is built to deliver solid performance right around the calendar. Outstanding new compression spring design offers finger-weight flexibility, yet the arm will not creep or sag when released. Springs are housed in a sturdy weatherproof steel case. Balance adjustments are accomplished with a hand wrench. The swivel joints on the arm have the dependability that has been associated with the name Chiksan for 30 years. Get the facts. Write for Bulletin 1-61.

FEATURING NEW TOTALLY ENCLOSED COMPRESSION SPRING—

Self compensating spring tension provides complete balance at any position. Compact design. No protruding brackets or counterweights.

4 MODELS FOR PETROLEUM SERVICE

Select from a complete line. All models—Folded Arm, Sliding Sleeve (shown above), Bottom Loader and Long Reach are available in 2, 3, and 4-inch sizes. Each model is a complete, ready for service, unit.

2 MODELS FOR CHEMICAL SERVICE

For loading or unloading virtually any chemicals, Chiksan offers a standard group of arms equipped with its DS series swivel joints. Available in Folded Arm model or Sliding Sleeve unit (shown at left).

WANT TO CONVERT EXISTING EQUIPMENT?

Chiksan Base Arm Sections permit operators to change existing facilities with minimum effort. Base Arm Sections are available in standard sizes of 2", 3", and 4". Riser joint supplied with threaded or flanged connections.

MAIL COUPON TODAY FOR COMPLETE INFORMATION

CHIKSAN fmc

#61-60

CHIKSAN COMPANY
330 North Brea Blvd., Brea, Calif.

Please send me your Bulletin 1-61.

Name_____

Title_____

Company_____

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City_____ Zone_____ State_____

CHIKSAN COMPANY—General Offices: Brea, California • Well Equipment Mfg. Corp. Division (Weco Unions, Hamer Valves) • Chiksan International • Chiksan of Canada Ltd.
Offices and Representatives in Principal Cities of the World

Bitumastic® No. 50 protects tank for corrosive, swamp-land service

The problem of protection for metal tanks in soils with high moisture content has long been a matter of concern to corrosion specialists: the protective coatings chosen must provide years of maintenance-free service and absolute resistance to corrosive attack by sub-soil moisture. Inspection and repair of buried tanks can be prohibitively expensive.

That's why five petroleum storage tanks, identical to that pictured above, were recently installed at a service station in Secaucus, New Jersey, after a costly failure of older tanks. Bitumastic No. 50 was chosen for heavy-duty protection of these tanks from sub-soil moisture in the loamy Jersey Meadow.

The surface of each tank unit was thoroughly cleaned, and then given a permanent covering of Bitumastic No. 50, the Koppers coating with tough, thick, water-resistant qualities for heavy-duty service.

The unique protective qualities of Koppers coal-tar coatings serve corrosion experts in almost every industrial and marine application. Bitumastic coatings have become synonymous with the finest form of corrosion protection available today. For information on the Bitumastic coating suited to your needs, send the coupon or write: Koppers Company, Inc., Pittsburgh 19, Penna. District Offices: Chicago, Los Angeles, Pittsburgh, New York and Woodward, Ala. In Canada: Koppers Products, Ltd., Toronto, Ontario.

KOPPERS

BITUMASTIC

COATINGS AND ENAMELS

another fine product of COAL TAR

KOPPERS COMPANY, INC.
Tar Products Division
Dept. 104G
Pittsburgh 19, Pa.

Gentlemen:
Please send me more information on the Bitumastic family of protective coatings.

Name_____

Firm_____ Title_____

Address_____

City_____ Zone____ State_____

▶▶▶ Equipment Men Notes

Chicago Pneumatic Tool elects

C. L. Lane

. . . Carra L. Lane and Thomas F. Noonan to new posts. Lane, presently manager of plant operations, was elected a vice president. He will continue supervising all manufacturing operations of the company's domestic plants at Utica, N. Y., Franklin, Pa., and Fort Worth. In addition, he will be responsible for coordinating operations of Chicago Pneumatic's wholly owned subsidiaries.

Noonan, a veteran of more than 20 years with the company, was also elected vice president. He continues in his capacity as comptroller, the post to which he was named in 1959.

Tube-Kote, Inc. announces

. . . a $250,000 expansion program for its Midland, Tex. plant. The expansion, expected to be completed by October, will double present production capacity, according to E. G. Holm, Tube-Kote president.

The company applies thermosetting plastic coatings to interior walls of oil-country-tubular goods to prevent corrosion. The Midland plant manager is William B. Borton. Sales representatives are Bob Griffin and John Perry.

John Waroblak named manager

. . . of petroleum company sales for B. F. Goodrich Tire Co. He succeeds John N. Brewster who recently became sales manager of B. F. Goodrich Australia, Pty. Ltd., a subsidiary at Melborne, Australia. Waroblak joined the Akron, Ohio firm in 1949.

Ralph N. Brodie Co. constructs

. . . a new headquarters and meter and valve service center for the midwestern states. Located in Forest Park, Ill., the 6,350-sq. ft. structure is now fully occupied by all departments. Earl D. Brodie, vice president, noted that the building contains more than twice the area of the former Forest Park plant, and will provide greatly increased facilities for engineering services, warehousing, sales, and service.

Oil Well Supply Division appoints

. . . a sales representative and two store managers. John J. Boslet takes over as sales representative of the store area at Beatyville, Ky. He previously held a similar post at Greensburg, Ky. Newly appointed store managers are James A. Durham, at Clarksburg, W. Va., and Harold J. Bourgeois, at Eunice, La.

BJ Service, Inc. names three

H. A. Coleman

. . . new assistants to the sales manager as part of an expansion program in the Mid-Continent and Gulf Coast regions, according to A. M. Birnie, vice president of the Borg-Warner subsidiary. The appointments involve Henry A. (Red) Coleman, Abilene division office; Jim B. Gardner, Corpus Christi sales office; and Herbert A. Bergman, New Orleans sales office.

Coleman is an 11-year BJ veteran. He became assistant district manager at Abilene and later was in charge

J. B. Gardner

H. A. Bergmen

of company field stations at Tyler, Abilene, and Wichita Falls. Gardner joined the firm in 1946, eventually becoming sales supervisor of the Midland division. He left the company in 1958 but returned 6 months ago as regional sales supervisor of the new Three Rivers, Tex., district. Bergman, a new BJ employe, worked for Kobe, Inc. as a sales and service engineer from 1948 to 1950. Since that time he has been with Welex, most recently as division sales manager.

Vinson Supply opens sales office

Ben Poelking

. . . in New Orleans and appoints Ben Poelking as manager, according to L. O. Barnett, president of the Tulsa-based organization. Poelking was with Standard-Southern Corp. in Houston for 5 years. For 6 years prior to that he worked for Bechtel Corp. in San Francisco.

The new office offers sales service on Crane valves, Nordstrom valves, Ladish welding fittings and flanges, National tubular goods, and Chase condenser tubing.

Charles R. McMahan is named

C. R. McMahan

. . . representative in London, England for Universal Oil Products Co., according to M. D. Gilchrist, UOP's senior vice president. McMahan succeeds the late F. A. Trim. Formerly area coordinator for the company's sales and licensing activities in the United States, Canada, United Kingdom, Europe, and the Middle East, McMahan joined Universal in 1945 as a field representative in the service department.

In 1954 he was named UOP sales representative operating out of Houston. McMahan joined the staff of Universal's commercial development department in 1956 and became an area coordinator in 1959.

Magcobar marketing region

. . . has been established in the Texas Gulf Coast by consolidating the personnel, equipment, and facilities of the corporation's Texas Gulf Coast region, a sales and service organization with headquarters at Houston, and Kaffie Lumber & Bulk Barites, Inc., of Corpus Christi. Headquarters are in Corpus Christi.

As a result of the consolidation, Magnet Cove Barium Corp.'s marketing region offers a complete drilling-mud service including sales,

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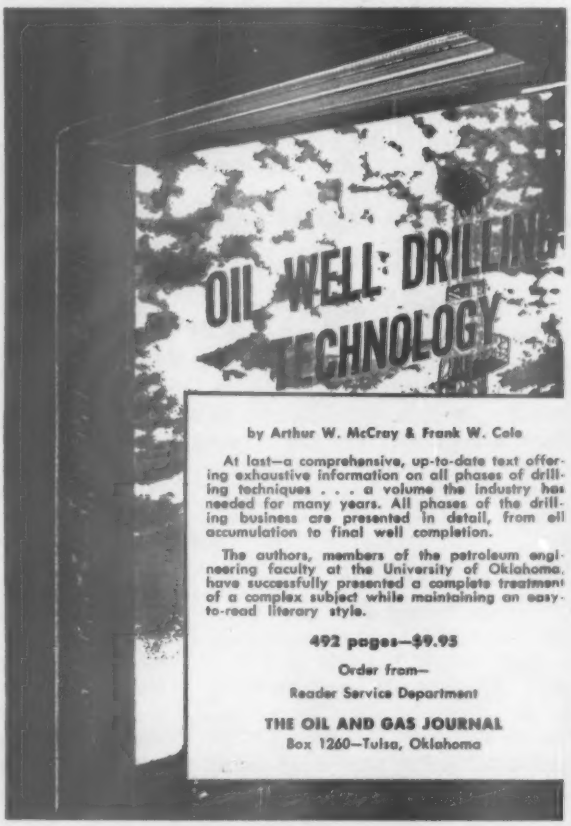

by Arthur W. McCray & Frank W. Cole

At last—a comprehensive, up-to-date text offering exhaustive information on all phases of drilling techniques . . . a volume the industry has needed for many years. All phases of the drilling business are presented in detail, from oil accumulation to final well completion.

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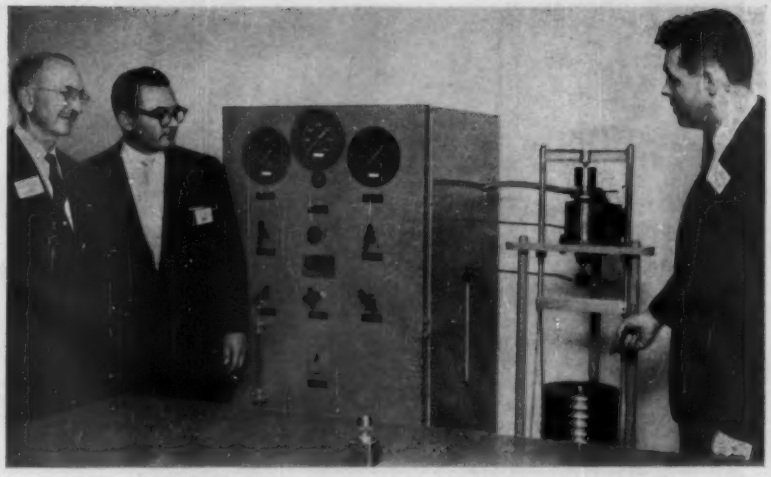
engineering service, and distribution. Facilities include 50 drilling-mud-warehouse stockpoints, bulk storage plants, and a recently expanded network of Magcobar liquid-mud plants.

Fred Pruter, Jr. is sales manager

Fred Pruter, Jr.

. . . of tubular products for International Inspection, Inc. (Triple-Eye), according to H. B. Hurley, senior vice president of the Halliburton subsidiary. A native of Dallas, Pruter was formerly with Sperry Western Co. for 5 years. Triple-Eye, formed in 1960, is engaged in ultrasonic inspection of oil-field-tubular goods and pressure piping and vessels.



DEAD-WEIGHT TESTING EQUIPMENT of Martin-Decker Corp. is explained by Clayton Howard, industrial sales manager, at Martin-Decker's recent open house. Looking on are Elmer Decker, president, and Milton Brenner, a guest from Brenner-Fiedler & Associates, Inc., Los Angeles. The open house was held to acquaint guests with the corporation's new facilities and products. A tour was made through M-D's new scientifically controlled calibration and primary standards lab. Guests were given detailed information on the birth and development of Martin-Decker's bourdon tube. Numerous scales, gages, and allied products were also on display.

Waukesha Motor Co. appoints

. . . Robert A. D'Amour as manager of manufacturer sales, and Roland R. Heideman as manager of distributor sales. The announcement was made by F. C. Schulze, vice president of sales.

D'Amour joined the company in 1952 after serving as sales engineer and assistant regional sales manager for Cummins Engine Mfg. Co. He became assistant sales manager in January 1960.

Heideman joined Waukesha's service division in 1934. In 1949 he was transferred to the sales division of the company's California

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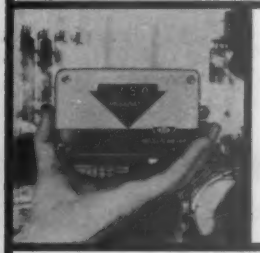

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branch. There he worked with West Coast distributors and engine-driven-equipment manufacturers as a sales engineer. Later Heideman became assistant branch manager.

Reed Roller Bit Co. names

... C. J. Fontaine and B. A. (Beau) Wendt to new top-ranking sales positions, announces W. E. Scarborough, vice president in charge of sales. Fontaine, divisional manager of Central America sales the last 16 years, was named domestic sales

C. J. Fontaine

B. A. Wendt

manager. Wendt, Texas Gulf Coast division sales manager, was elevated to assistant to the vice president of sales.

Fontaine will direct sales and service of Reed rock bits, tool joints, and drill collars throughout the U. S. Wendt will serve directly under Scarborough, coordinating sales activities of Reed oil tools. Both men will continue to serve in their previous capacities in addition to assuming these new responsibilities.

G. S. Leonard is manager of mfg.

... of Cameron Iron Works, Inc.'s Pressure Control Equipment Division. Leonard was formerly works manager of National Supply's Houston plant. He is a director and former president of the Association of Well Head Equipment Manufacturers.

J&L Supply assigns four

...store managers, according to A. G. Bastian, manager of field operations. Assigned were: K. E. Manford, Corpus Christi; B. T. Collins, Laurel, Miss.; W. F. Rice, Pleasanton, Tex.; and R. L. Mikulec, Victoria, Tex.

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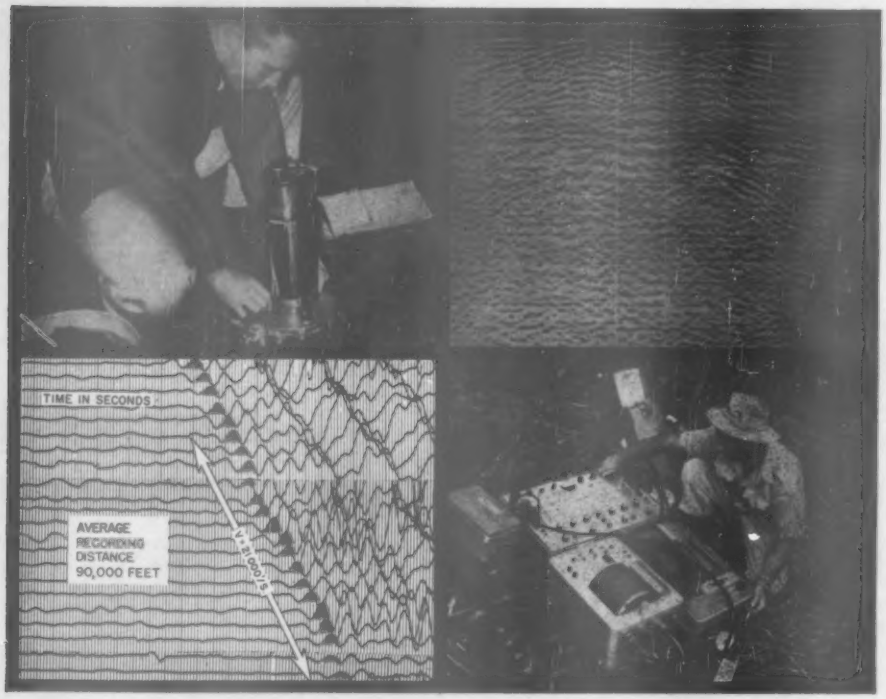

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Canadians pin high hopes on Arctic test

BY FRANK J. GARDNER

LOCATION FOR THE FIRST exploratory drilling for oil or gas in the Canadian Arctic Islands is tentatively set for the Winter Harbour area of Melville Island, 1,050 miles from the North Pole. Drilling will commence next September if all goes well.

SANTA CLAUS will come in August this year. And he'd better be generous, or there'll be a lot of disappointed Canadians.

The drilling of the first wildcat (aptly dubbed now by Canadians as a "polarcat"), in the Arctic Islands of North America must rank right alongside Mohole as one of the most significant exploratory events of this or any other year.

The project, to be known as "Operation Santa Claus," will get under way late in August. Equipment for drilling the well will be shipped from the Simonette area of western Canada to Montreal in time for the northern convoy to leave in late July. Peter Bawden Drilling, Ltd., will be the contractor. Rig to be used is capable of drilling to 11,500 ft.

Cooperative effort . . . Dome Petroleum, Ltd., will be the operator of this important well. Dome has two possible drill sites in mind, one on Melville Island and another on Bathurst Island, but the spot shown on the map is the more likely one. Here, photogeology and aeromagnetic surveys have revealed a great anticlinal surface structure some 38 miles long, 8 miles wide, and with about 1,500 ft. of closure.

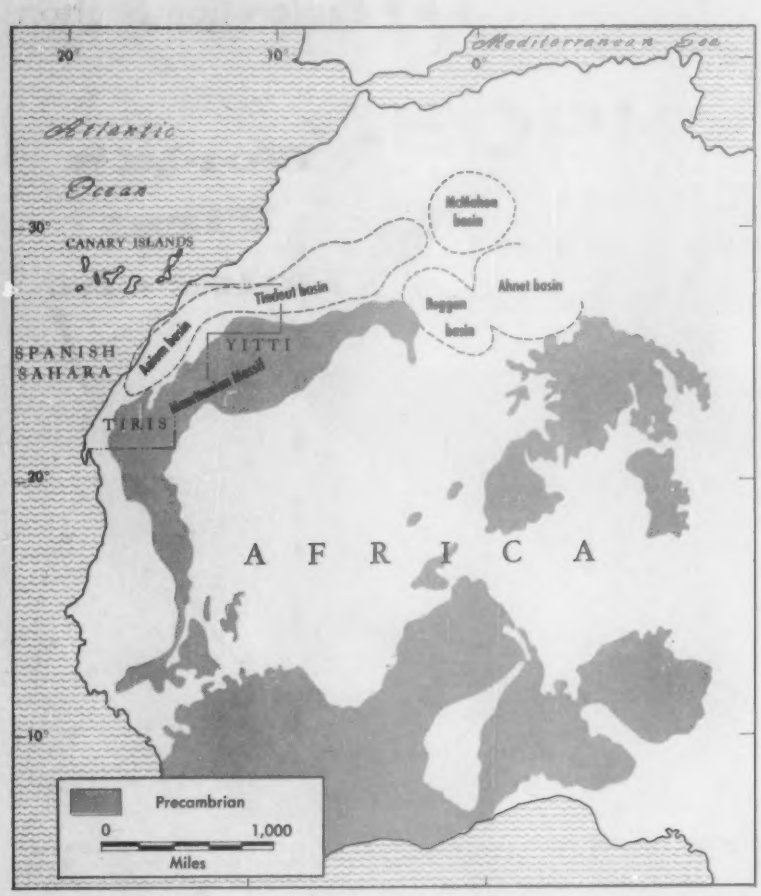
The test well is a cooperative venture, and its spudding will climax months of planning; other companies supporting the polarcat are Round Valley Oil Co., Ltd.; Union Oil Co. of California; Canada Southern Petroleum, Ltd.; Tidewater Oil Co.; Clark Oil & Refining Corp.; Dominion Explorers Group; Bankeno Mines, Ltd.; and Provo Gas Producers, Ltd. Some idea of the economics involved can be had by reading the story on Page 76 of this issue.

The Winter Harbour anticline spans Dundas Peninsula completely in a northwest-southeast direction, and plunges for an unknown distance into the waters of Viscount Melville Sound. Dome estimates a 13,000-ft. sedimentary section for the area. Surface rocks are of Devonian age, and the operator expects to bottom the hole in Silurian. The prime purpose of the well, according to Dome's announcement of it, is to obtain subsurface stratigraphic information, but in a less altruistic vein, company geologists declare: "We're looking for **big** oil—in billions of barrels, not just barrels."

May justify the hope . . . And billions there may be. For every geologist who has studied the islands has issued glowing reports on the possibilities for big oil underlying them.

One of the most recent and comprehensive appraisals of these possibilities is now available from the Institute of Petroleum, 61 New Cavendish Street, London, W.1, England; its title: "Queen Elizabeth Islands of Arctic Canada and Their Petroleum Prospects," by A. Bryce Cameron, of Lobitos Oilfields Canada, Ltd. Summarizing, Cameron says: "No oil or gas seeps have been discovered . . . but the signs of petroleum that have been reported in literature and the evidence obtained from geological surveys of the last two seasons show without doubt that the sedimentary rocks of the Queen Elizabeth Islands do provide an oil habitat."

Much depends on the outcome of this first drilling of a completely untested sedimentary basin. Failure could delay or discourage further testing for years to come. Success, if it comes, must be colossal if the islands are to be commercially profitable. It's all up to Santa Claus.



GEOLOGIC provinces of the Spanish Sahara are similar to its environs.

Spanish Sahara offers real prospects for oil

About the author...

JOHN B. CARRIER is consulting geologist in Casper, Wyo., specializing in the northern Rockies. Previously he was a district geologist for Superior Oil Co. in Casper for 12 years, and held a similar capacity in Oklahoma City for Superior for the preceding 4 years. He also worked with Skelly Oil Co. in Wichita for 5 years as petroleum geologist and before that was a subsurface geologist with the Iowa Geological Survey. Carrier received a BA degree from Wichita University in 1939 and an MS from the State University of Iowa at Iowa City in 1941.

SPANISH SAHARA should be of intense interest to the oil industry because of its geologic relationship to other portions of the Sahara region. Some of the world's largest reserves are being developed in Algeria and Libya from structural basins and provinces that are genetically related to similar features in the Spanish Sahara. The Tindouf basin extends into northern Spanish Sahara and the Aaiun basin, of unknown depth, covers the western half of the country. Should the stratigraphic section in these basins prove similar to that of the North-Central Sahara, the oil possibilities for Spanish Sahara will be very real indeed.

This discussion is based on a reconnaissance field study conducted in the Spanish Sahara during the months of May, June, and July 1959. This survey was made from fixed-wing aircraft and helicopter, followed by an additional eight weeks of ground-conducted field work from field-based camps, using Land Rover vehicles.

Topography. The country here slopes gently up from sea level to a maximum height of approximately 1,500 ft. Most of the area paralleling the coast line is a flat featureless plain called the Hamada. Rare strips of barchane dunes are aligned north-northeast indicating predominant wind direction. In the interior the Hamada is broken by erosion into scattered flat-topped mesas and isolated patches which unconformably overlie older beds.

Only one drainage system of importance is present, the Saguia el Hamra which, together with the tributary Terguet, forms a normally dry stream course several miles wide. This drainage trends east-west through the north half of the country. North of this drainage the Paleozoics are dissected into flat-topped erosional mesas of several hundred feet relief.

The Precambrian Massif is exposed as a low-relief area in the south and east portions of the country. The Paleozoics south of the Saguia el Hamra outcrop in successive bands of low cuestas which have north and west-dipping back slopes.

Geologic section data. The Paleozoic section is not completely exposed in any one area; however,

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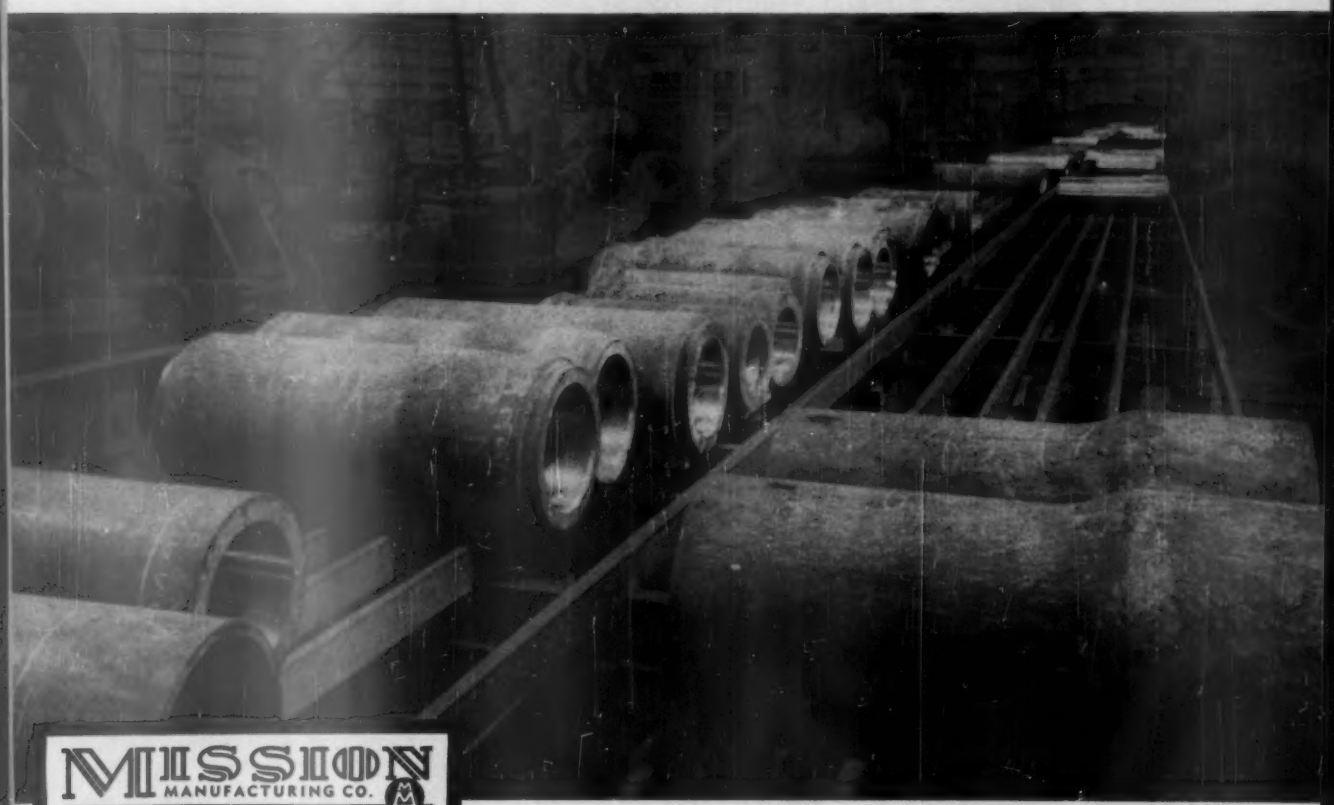

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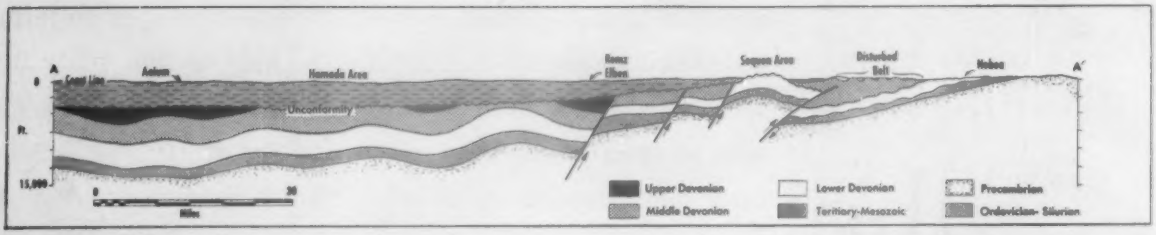


NORTHWEST TO SOUTHEAST cross-section shows that sedimentary section varies in thickness from more than 10,000 ft. to 0 with faulting, some thrust, in the Sequen area.

most of these beds may be studied along a general cross-section line extending from the Precambrian contact northwestward to the vicinity of Semara. This section includes Ordovician, Silurian, and Lower, Middle, and Upper Devonian exposed in normal sequence against the Yitti and Tiris portions of the Precambrian Mauritanian Massif.

The Carboniferous, together with additional Upper Devonian sections, may be observed and measured in the north-central portion of the country, even though only a very small area of Carboniferous is exposed in Spanish Sahara. This is found along the north border approximately 90 miles northeast of Semara.

The exposed Paleozoic section is predominantly clastic. Limestone comprises about 6% of the total, and much of that is fragmental and sandy. Neritic environment is indicated throughout the section by abundant ripple marks, worm trails, and plant (?) remains. Pockets of depauperate fauna commingled with red shale and evaporites are found in the Devonian, largely along the westernmost exposures.

Most of the section is profusely fossiliferous, abounding in a very diversified assemblage of invertebrates. In addition, there are in Middle Devonian at least three zones of very fossiliferous limestone; these develop locally into sizable bioherms. These colonies are reflected in the topography as rounded, isolated hills, one group of which is prominently exposed in the valley of the Terguet drainage.

The Mesozoic section which comprises the interior Hamada was described at Gor el Berd, a prominent butte 15 miles southwest of Semara. This section is mainly shale with about 25% sandstone and a few thin coquinoid limestone beds near the base. These post-Paleozoic beds are assumed to thicken toward the coast through the region of the Aaiun basinal axis; however, complete exposures required for accurate determination are unavailable in that area.

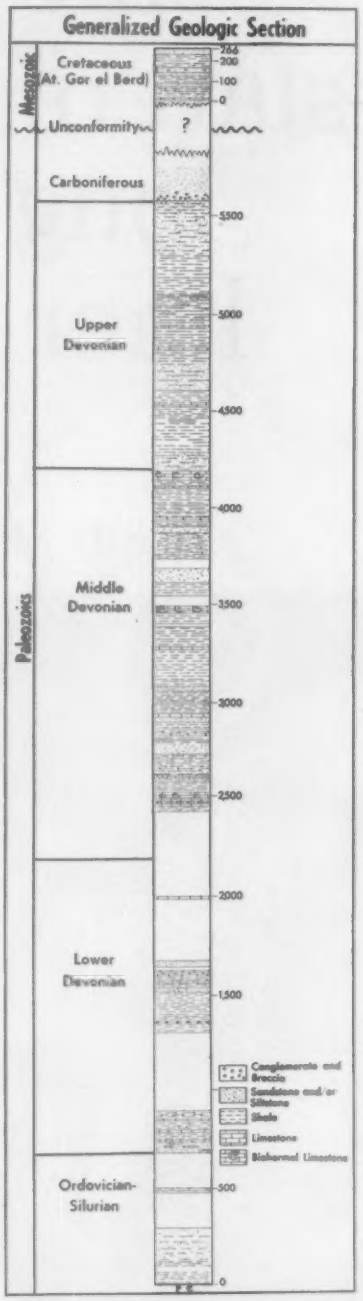
Geologic structure. The Precambrian Sahara Shield is formed in this area by the Mauritanian Massif, which is divided into two parts: the Yitti, on the north, bounds the south rim of the Tindouf basin; the Tiris portion flanks the Aaiun basin on the east.

The Paleozoics are exposed as bands which warp around the Precambrian Massif changing strike, in the vicinity of Semara, from east-west in the Tindouf basin to N 30° to 40° E in the Aaiun basin.

A very prominent local structural feature is the "folded belt" which extends on the surface from the Saguia el Hamra, near Semara, southwestward through Guelta Zemmur and continues an undetermined distance. This belt of sharply folded beds ranges in observed width from 16 miles at Semara to over 30 miles west of astronomical point Nebca. The actual width of this belt is not known due to Hamada cover, which overlaps the western side along its entire length. The structures in this belt are long, narrow, sinuous folds, steep-sided and very closely spaced.

Very little surface faulting is associated with them. Those at the northern end are aligned roughly north-south; at the southern end the "grain" is more north-northeast. Maximum stratigraphic closure is less than 500 ft., with a very limited section of Middle and Upper Devonian involved in the folding. These folds are interpreted as relatively shallow rootless structures marking a subsurface fault zone.

The folds along the western side of this disturbed belt are apparently larger in area and probably involve



IT WILL TAKE the drill bit to determine which portions of the stratigraphic column will produce in Spanish Sahara. One can only guess which of these beds that produce elsewhere in Africa will pay off here.

This Halliburton Chemist is operating a Pan American Thickening-Time Tester. It simulates pumping of cement under the pressures and temperatures in the well even under the severest conditions. Other tests performed in Halliburton field laboratories include establishing proper cementing composition, determining water requirements, slurry viscosity, compressive strength tests and water analysis. Tests for fracturing and chemical services are also performed.

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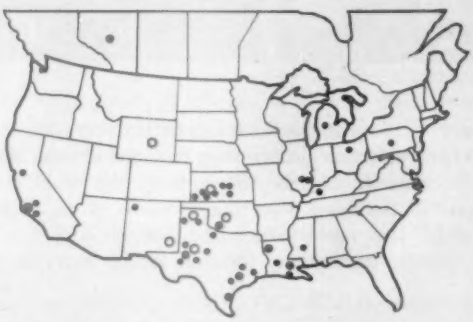

● Locations of Halliburton Field Labs span the oil country. Labs in Duncan, Okla.; Edmonton, Alberta; Norwark, Calif.; Lafayette, La.; Corpus Christi, Texas; Houston, Texas; Odessa, Texas; Bossier City, La.* are equipped with Pan American Thickening-Time Tester. ⊙ Other well staffed labs are in Great Bend, Kan.; Lovington, N.M.; Oklahoma City, Okla.; Abilene, Texas; Perryton, Texas, and Casper, Wyo. • Other field location labs where limited testing facilities are available are in Liberty, Tex.; Beaumont, Tex.; El Campo, Tex.; Morgan City, La.; Harvey, La.; Farmington, N.M.; Monahans, Tex.; Snyder, Tex.; Rankin, Tex.; Andrews, Tex.; Wichita Falls, Tex.; Montalvo, Calif.; Bakersfield, Calif.; Rio Vista, Calif.; Winfield, Kan.; El Dorado, Kan.; Pratt, Kan.; Hays, Kan.; Liberal, Kan.; Pampa, Tex.; Borger, Tex.; Elkhart, Kan.; Russell, Kan., Flora, Ill.; Crossville, Ill.; Henderson, Ky.; Mt. Pleasant, Michigan; Wooster, Ohio; Bradford, Pa.; and Laurel, Miss.
*Under construction.

Only Halliburton has so many fully equipped field laboratories which can provide such a variety of tests on any cementing composition. This testing becomes most important for such down-hole problems of high temperature, lost circulation, corrosion and tubingless completions where special slurry mixtures are essential. Thickening time tests on the specific batch of cement that may be required for your well are performed under precisely simulated down-hole conditions. Then Halliburton runs compressive strength tests for you which indicate waiting-on-cement time.

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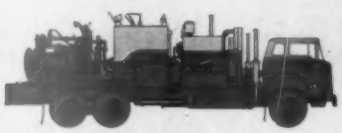

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UNION UNI-CORE WIRE ROPE

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- ☐ 18 months
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- ☐ 30 months
- ☐ 36 months

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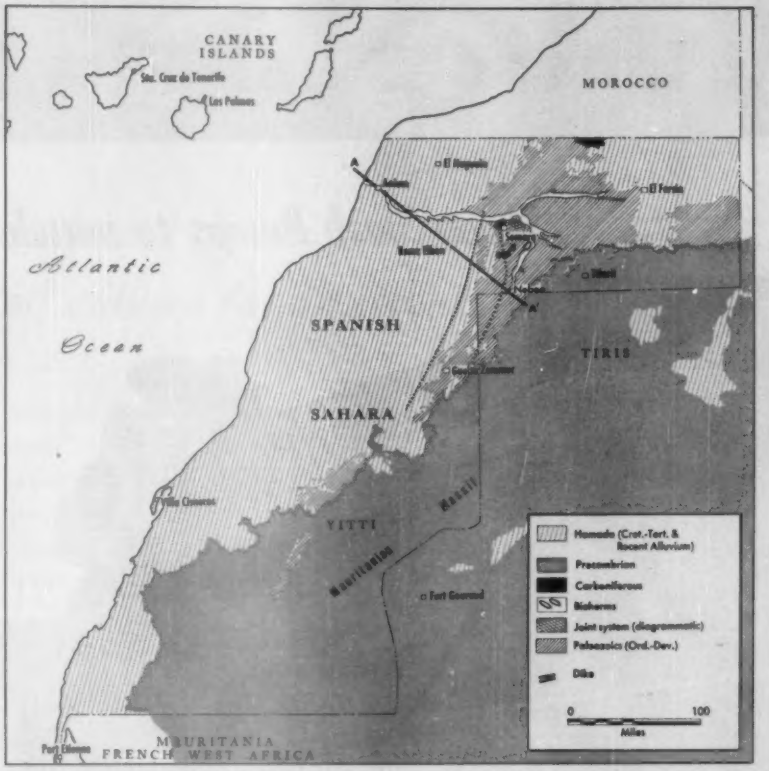
Union Wire Rope, Armco Steel Corporation, 2102 Manchester Ave., Kansas City 26, Missouri.

Make Your Guess Before You Read This

Total up all the figures in the above panel and divide by seven. That's how long it has been servicing oil wells up to this date. It is still on the job giving excellent service and gives every indication of giving many more months of service.

ARMCO Union Wire Rope



MAJOR surface structures occur along west edge of Mauitanian Massif.

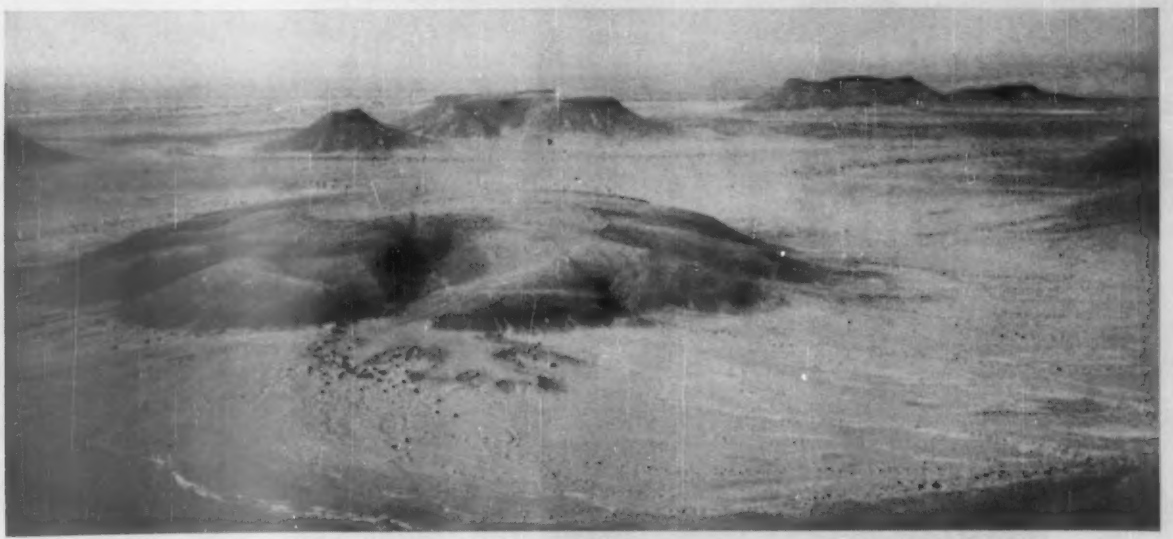
rocks of different facies and thicker sequence than do those on the eastern side. The age of folding is not definitely known, but is believed to be Hercynian.

Three occurrences of igneous activity were noted within the folded belt. Two of these were dikes injected into the folds, cutting them at right angle to the direction of structural grain. These dikes are postfolding in age, penetrating the section at least 2,800 ft., into Middle Devonian. One dike was found 10 miles northwest of Semara, the other 20 miles south of there. The third observed occurrence of igneous material is a basalt-like rock probably injected into the section as a sill and incorporated into the folding of the disturbed zone. It was located in the area immediately to the south of the Sequen. Preliminary geophysical data indicate more extensive igneous intrusive activity west of the folded belt beneath the Hamada cover.

Further evidence on the surface of structural disturbance at the junction of regional strike change is a well-developed joint system in Upper Devonian beds immediately northeast of Semara. This feature consists of two sets of crossjoints marked by ruler-straight lines of heaved shale 2 ft. in height. The joints form a widespread pattern of ¼-mile grids, with two joint systems oriented N 75° W and N 10° E. This pattern may represent the indirect effect of basement tectonics along the saddle area between the Tindouf and Aaiun basins.

Surface reconnaissance failed to demonstrate significant structure in Hamada beds. Dip in Mesozoic and Tertiary strata is uniformly low, rarely measuring more than 2°. Approximately 25 miles west of Semara along the road between that station and Aaiun, steep dips were observed in beds of uncertain age; however, it is thought that these are strata associated with the folded belt directly to the east.

Oil possibilities. Paleozoic beds exposed in the Spanish Sahara are predominantly shallow-water clastics filled with abundant fossil remains. Highly organic green shales



EXPOSED BIOHERM REEF of Middle Devonian is near the Terguet River Valley.

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	D-125	D-225	D-375	D-550
Maximum Liner Size by Stroke	7¼" x 10"	7¼" x 12"	7½" x 14"	7½" x 16"
Piston Rod—Diameter and Taper	1¾"—3 API	1⅞"—4 API	2"—4 API	2½"—5 API
Fluid End Test Pressure	3500 psi	3500 psi	4000 psi	6000 psi
Suction Manifold	8" Female	8" Female	10" Male	10" Male
Discharge Manifold	3" Female	3" Female	4" Female	4" Female
Gear Ratio	4.96:1	5.43:1	5.04:1	5.04:1
Gear Face	5"	9"	11¼"	13"
Pinion Shaft Extension (Clear)	9½"	9⅞"	12⅛"	15⅛"
Bearing	Roller	Roller	Roller	Roller
Keyway	1" x ½"	1" x ½"	1¼" x ⅝"	1½" x ¾"
Eccentric Drive Bearings	Roller	Roller	Roller	Roller
Main Shaft Bearings	Self Align	Self Align	Self Align	Self Align
Crosshead Bearings	Double Needle Roller	Double Needle Roller	Double Needle Roller	Double Needle Roller
Length—Overall	11'—2"	12'—6"	14'—8"	16'—8"
Width				
Overall—Inc. Shaft Ext.	4'—½"	4'—1⅝"	4'—8"	6'—8⅛"
Fluid End	3'—8½"	3'—8½"	4'—1"	4'—6½"
Power End—Inc. Shaft Ext.	4'—½"	4'—⅝"	4'—4½"	6'—5"
Skid	3'—3½"	3'—7⅝"	3'—6½"	6'
Height—Less Air Chamber	3'—9"	4'—½"	4'—9"	5'—4½"
Approximate Weight	8,700 lbs.	13,000 lbs.	18,300 lbs.	29,000 lbs.

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14"	16"	18"
14"	15"	15"
Roller	Roller	Roller
1⅜" x ⅝"	1⅜" x ⅝"	1⅜" x ⅝"
Roller	Roller	Roller
Self Align	Self Align	Self Align
Double Needle Roller	Double Needle Roller	Double Needle Roller
18'—4⅞"	20'—2"	20'—2"
7'	8'	8'
4'—8½"	6'—6"	6'—6"
6'—7½"	6'—4¼"	6'—4¼"
7'	8'	8'
6'	6'—4½"	6'—6"
37,500 lbs.	48,800 lbs.	50,500 lbs.

PERFORMANCE DATA

	Strokes Per Min.	Max. B.H.P. Input	Operating Data	LINER SIZE										
D-1000				8¼"	8"	7¾"	7½"	7¼"	7"	6¾"	6½"	6¼"	6"	5¾"
	60	1000	G P M Output	933	874	817	760	706	653	603	553	507	462	419
	50	833	G P M Output	778	728	680	633	588	545	503	461	423	385	349
	40	667	G P M Output	623	582	544	506	470	436	402	369	338	308	279
			Gallons per Revolution	15.56	14.57	13.59	12.66	11.75	10.89	10.05	9.22	8.45	7.71	6.99
			Max. Disch. Pressure	1562	1668	1782	1917	2068	2239	2419	2635	2871	3153	3480
DA-850				8¼"	8"	7¾"	7½"	7¼"	7"	6¾"	6½"	6¼"	6"	5¾"
	60	850	G P M Output	933	874	817	760	706	653	603	553	507	462	419
	50	708	G P M Output	778	728	680	633	588	545	503	461	423	385	349
	40	567	G P M Output	623	583	544	506	470	436	402	369	338	308	279
			Gallons per Revolution	15.56	14.57	13.59	12.66	11.75	10.89	10.05	9.22	8.45	7.71	6.99
			Max. Disch. Pressure	1326	1416	1516	1630	1759	1896	2065	2240	2440	2680	2956
DA-700				8¼"	8"	7¾"	7½"	7¼"	7"	6¾"	6½"	6¼"	6"	5¾"	5½"
	65	700	G P M Output	909	852	796	743	690	640	591	544	499	456	414	374
	55	592	G P M Output	769	721	674	628	584	541	500	460	422	386	350	317
	45	485	G P M Output	630	590	551	514	477	443	409	377	346	316	287	259
			Gallons per Revolution	13.99	13.10	12.25	11.42	10.61	9.84	9.09	8.37	7.68	7.02	6.37	5.76
			Max. Disch. Pressure	1120	1197	1281	1374	1478	1593	1726	1875	2044	2236	2463	2727
D-550				7½"	7¼"	7"	6¾"	6½"	6¼"	6"	5¾"	5½"	5"	4¾"
	65	550	G P M Output	751	699	649	600	553	509	464	423	383	346	309	275
	55	465	G P M Output	636	592	549	508	468	430	393	358	325	293	262	233
	45	331	G P M Output	520	484	449	415	383	352	321	292	266	239	214	190
			Gallons per Revolution	11.55	10.76	9.98	9.23	8.51	7.82	7.14	6.51	5.90	5.32	4.76	4.23
			Max. Disch. Pressure	1067	1146	1235	1336	1449	1577	1727	1894	2090	2317	2580	2913
D-375				7½"	7¼"	7"	6¾"	6½"	6¼"	6"	5¾"	5½"	5¼"	5"	4¾"
	70	375	G P M Output	723	674	626	581	536	494	472	414	376	341	307	274
	60	321	G P M Output	620	577	537	498	460	423	405	355	323	292	263	235
	45	241	G P M Output	465	433	403	373	345	316	303	266	242	219	197	176
			Gallons per Revolution	10.328	9.628	8.948	8.294	7.663	7.058	6.743	5.913	5.378	4.867	4.379	3.915
			Max. Disch. Pressure	744	810	871	939	1018	1104	1156	1318	1451	1600	1777	1991
D-225				7¼"	7"	6¾"	6½"	6¼"	6"	5¾"	5½"	5¼"	5"	4¾"	4½"
	70	225	G P M Output	580	539	500	462	426	391	357	325	295	265	237	211
	60	193	G P M Output	497	462	429	396	365	335	306	279	252	227	203	180
	45	145	G P M Output	373	347	321	297	274	251	229	209	189	171	153	136
			Gallons per Revolution	8.293	7.708	7.142	6.602	6.083	5.583	5.104	4.646	4.206	3.790	3.392	3.015
			Max. Disch. Pressure	558	607	654	708	769	836	916	1007	1111	1234	1379	1551
D-125				7¼"	7"	6¾"	6½"	6¼"	6"	5¾"	5½"	5¼"	5"	4¾"	4½"
	85	125	G P M Output	560	537	509	471	434	399	365	332	301	271	243	216
	70	103	G P M Output	466	439	416	388	357	328	300	273	248	223	200	178
	55	81	G P M Output	382	361	329	305	281	258	236	215	195	176	157	140
			Gallons per Revolution	6.940	6.456	5.988	5.538	5.104	4.688	4.288	3.906	3.540	3.192	2.860	2.546
			Max. Disch. Pressure	308	328	357	386	419	456	499	548	604	670	748	846

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LARGE surface features such as this folded belt are present.

make up an estimated one-fourth of the measured section. If these same sedimentation conditions exist basinward, they should, under proper reducing conditions, make suitable source beds for oil. Although only sparse outcrops of Ordovician-Silurian beds were examined, most of the limestones of this section were highly organic, with strong sulfurous odor on fresh break. This portion of the section could also well serve as source beds for petroleum.

On the basis of surface exposures, reservoir beds are not abundant in the Paleozoic section. There is exposed 400 ft. of limestone and sandstone which develops varying amounts of porosity. In addition, an aggregate thickness of 250 to 400 ft. of biohermal material occurring in several zones should be included as potential reservoir section. The Carboniferous, in the locality measured, consists of nearly 200 ft. of sandstone and quartzite. It is very hard and tight on the outcrop, but has possibilities of developing suitable reservoir characteristics if present in the subsurface.

Along the western side of the exposed Paleozoics, as they dip under the Hamada into the Aaiun basin, the section appears to thicken, with several very thick exposures of limestone, quartzite, friable porous sandstones and conglomerates exposed in part. These are believed to be Devonian and may indicate much better developed reservoir conditions in the Paleozoic section to the west.

Little is known of the oil possibilities in the Mesozoic - Tertiary section. As noted elsewhere, surface structure is lacking over the Hamada region. Also, because of very limited exposures, the reservoir possibilities are virtually unknown. However, Cretaceous production is being obtained south of Spanish Sahara in Senegal, and Tertiary oil is produced in Gabon further down the west coast of Africa; therefore, these beds should be considered as possible pay zones. Given the proper stratigraphic conditions along the basal unconformity surface, or suitable subsurface structure, these beds may prove productive.

Structure diagrammed on cross-section A-A in the figure at left is generalized and largely inferred from scant evidence; however, all data available at present indicate good possibilities for substantial structure throughout the deeper portions of both the Tindouf and Aaiun basins in the Spanish Sahara.

The drill will undoubtedly evaluate many of these structures in the near future. Gulf Oil Corp. is currently conducting a drilling program in the northwest quarter of the country. Results have not been released.

Operations. The geologic field worker in this area has available two published reports on the general geology of the country.[1,2] Two published geologic maps are likewise available from the Spanish Government. The first, by D. Manuel Alía Medina, scale 1:2,000,000, was published in 1952. The second, compiled by D. José de la Viña and D. Carlos Muñoz Cabezón, scale 1:1,500,000, was printed in 1958. Although the latter map, at that scale, is of little value for detailed work, it is an excellent reference map for general consideration.

The United States Air Force has available jet-pilot maps of this region; these are included in their world-wide coverage set. These maps are not sufficiently accurate for field use.

A Spanish military map, scale 1:500,000, is obtainable. On it are shown topography by hachures, drainage, principal roads, settlements, and astronomical points. The latter, intended as ground control for the map, which was apparently constructed from aerial photographs, are virtually useless because the sites were not permanently marked. With few exceptions the cairns set up by the surveying parties have been obliterated. Those

JOINT PATTERN developed in the Upper Devonian beds is apparent in aerial view northeast of Semara.

which remain cannot be certainly identified. In spite of certain shortcomings this base is the only suitable one readily obtainable for field use.

No aerial photographs were available at the time the field work was undertaken; however, trimetrogon coverage is obtainable from the USAF in Washington, D. C., and it is understood that limited commercial coverage is also now on the market.

Graded roads are nonexistent in the Spanish Sahara. Military roads are simply paths established by truck convoys. Fortunately, the desert has little relief, and most areas can be negotiated with care by Jeeps and Land Rovers.

Water is a problem, being scarce and of uncertain quality. In a few areas it may be obtained by digging in dry stream courses to a depth of 7 to 20 ft.; however, most water must be transported from the few widely scattered wells or from the Spanish military settlements. Limited food supplies and other provisions may be purchased from the army commissaries at Aaiun and Semara, but most supplies are better obtained in Las Palmas, Canary Islands. These are landed on the beach at the "mouth" of the Saguia el Hamra and trucked inland to Aaiun and other supply points.

Government permits to operate in the Spanish Sahara are cumbersome and the supply of official red tape seems endless. For the most part, however, the Spanish military, which controls the area, is very cooperative, helpful, and reliable, but very slow in making decisions and granting official permissions. Lesser officials are most reluctant to render any sort of decision affecting foreign operations without clear-cut written authority from their superiors.

Acknowledgment

The writer is indebted to Superior Oil Co. for permission to publish this material.

References

Manuel Alía Medina:

1. "Caracteristicas Morfograficas Y Geologicas de la Zona Septentrional del Sahara Español," Trabajos del Instituto de Ciencias Naturales, Madrid, 1945, Tomo II.
2. "Contribucion al Conocimiento Geomorfologico de las Zonas Centrales del Sahara Español," Instituto de Estudios Africanos, Madrid, 1949.

SEMARA is the site of a Spanish military post in the interior where the Upper Devonian beds are expressing regional dip.

Kansas committee names 11 new oil strikes

THE Kansas Geological Society Nomenclature Committee has given names to 11 new oil discoveries at its June meeting.

Cowley County. Gralapp and Everly 1 Bolack, SE NW NW 21-32s-6e, opens Bolack field. The well, 10 miles east of Winfield, pumped 150 bbl. of oil and 50 bbl. of water per day from Cattleman sand perforations at 2,842-49 ft.

Decatur County. Kathka is a new field opened by Empire Drilling Co. at 1 Kathka in C SE NE 7-1s-28w, 3 miles east of Cedar Bluffs. The well swabbed 5½ bbl. of oil per hour from Lansing - Kansas City Pennsylvanian perforations at 3,606-18 ft.

Ellis County. Don E. Pratt 2 Keller "E," SE SE NW 23-14s-20w, 9½ miles southwest of Hays, opens Spring Hill field. The well swabbed 5 bbl. of fluid per hour, 50% water, from open hole in the Arbuckle Cambro-Ordovician lime.

Graham County. Culp is a new oil field at Empire Drilling Co. 1 Culp "A," C NW NE 21-10s-24w, 13 miles southwest of Hill City. The well flowed 15 bbl. per hour from Lansing-Kansas City perforations at 3,839-45 and 3,995-99 ft.

Grant County. Davatz oil field was opened at Columbian Fuel Corp. 2 Davatz "B" in C SE NW 13-28s-36w, 8 miles northeast of Ulysses. The well swabbed 6 bbl. of oil hourly from Morrow Pennsylvanian sand perforations at 5,231-32 ft.

Ryus oil field was opened at United Producing Co. 2 McCabe unit in C SE NE 30-30s-35w, 1½ miles southeast of Lawson. This well swabbed 5 bbl. of oil per hour from Marmaton Pennsylvanian perforations at 4,699-4,701 ft.

Haskell County. Santa Fe field was opened at Walter Kuhn 1 Masoner, C SW SW 30-28s-32w, 6½ miles northwest of Sublette. This well recovered 2,200 ft. of oil on a drill-stem test at 5,303-5,500 ft.

Kiowa County. West Fralick oil field was opened at Falcon-Seaboard Drilling Co. 1 Brensing in C SE SE 16-27s-20w, 6½ miles northwest of Mullinville. It made 35 bbl. of oil and 4,250 M.c.f.d. from Mississippian perforations at 4,868-78 ft.

Osage County. Vassar is a new pool at Messman-Rinehart 1 Woodward in NW NE NW 23-16s-16e, 4½ miles northeast of Lyndon. The well swabbed 3 bbl. of oil per hour from perforations at 1,546-64 ft.

Pawnee County. Southeast Oro field was opened by Mull Drilling Co. at 1 Harms in NE SE NW 23-20s-19w, 8 miles northeast of Burdett. The well pumped 41 bbl. of oil per day from Cherokee Pennsylvanian perforations at 4,218-23 ft.

Rice County. East Frederick oil pool was opened at Bear & Goodin 1 Bronleewe in C SW SW 12-18s-9w, 9½ miles northwest of Lyons. The well is testing Simpson Ordovician pay at 3,288-95 ft.

Michigan St. Clair to hold interest

Three more areas in St. Clair County probably will get discovery attention although none of the three plays is remote from other pools.

Frank Stratton 1 Babel, NE NW SE 33-4n-16e, China Township, St. Clair County, tested 750 M.c.f.d. at 2,324-36 ft. in the Salina A-1 section. The wildcat is 2 miles northwest of Marine City oil and gas pool (A-1 and Niagaran reef pays).

McPheron and Bissett 1 Stenzel, SE NW SW 30-4n-15e, Casco Township, St. Clair County, tested gas section 2,610-25 ft. and possible oil section at 2,719-32 ft. in the Salina A-1 above the Niagaran.

McClure, Hartman, and Panhandle 1 Osterland, C NW NE 7-3n-16e, Cottrellville Township, St. Clair County, gaged 3 M.M.c.f.d. at 2,347 ft. in the A-1 contact. Drilling was halted to switch to core rig. The location is 2 miles east of the Ira gas pool and ¼ mile from a small 40-M.c.f.d. gas well drilled 2 years ago.

Gene Goff 1 Russell, NW NW NW 23-4n-6e, Tyrone Township, Livingston County, a remote wildcat, is testing Niagaran section gas show at 5,014 ft. Pay was reported drill stemmed at 160 M.c.f.d. but after acid and fracture commercial results were unconclusive after 5 days of swabbing.

New Wilcox publication available

Available is a publication by the Shreveport Geological Society dated April 1961, entitled "Oil and Gas-Producing Zones in the Wilcox (Eocene) of Central Louisiana."

This publication is a compilation of the results of approximately 2 years of research by the Wilcox Log Committee. The scope of the book includes tabulated data on Wilcox producing zones in 122 fields and type electric logs to demonstrate the stratigraphic position of each producing zone. Copies are available at Shreveport Geological Society, P. O. Box 750, Shreveport.

Test set for Texas' Edwards

A remote wildcat is slated for the extreme southwestern corner of Edwards County in Southwest Texas.

The 12,500-ft. prospect is Val Verde Venture, A. M. Lloyd, operator, 1 J. H. Harding, Section 27, Block J.G.A. TCR Survey, A-1307. Location is 6 miles southwest of Carter Valley near the Val Verde and Kinney County lines. Limited production of Edwards County exists in the north and northwest parts of the county. The southwest corner of the county doesn't produce. This wildcat will go a long way toward finding out more about the prospects of this practically unknown region of Texas.

Another wildcat is going to start July 1 at Mayfair Minerals 1 S. N. Brown, 15 miles southwest of Rock Springs. It will go to Ellenburger and 8,500 ft.

Texas Gulf Coast. Crescent Oil & Gas Corp. 1 J. R. McLane "B" is a new Frio gas discovery in southwestern Colorado County, 4 miles west of Garwood and 4,800 ft. southwest of 1 McLane, recent new pay discovery.

The new well flowed 1,120 M.c.f.d. through 12/64-in. choke from perforations in the Frio at 3,605-7 ft. Calculated open flow was 30 M.M.c.f.d., dry. Location is in I&GN Survey, A-305, Section 48.

Second producer added to East Fay in Oklahoma

A new western Oklahoma field added its second producer at Texaco Inc. 1 Winter, C NE SW 3-5n-13w, Blaine County.

The well flowed 4,600 M.c.f.d. and 2 bbl. condensate hourly from perforations in the Morrow Pennsylvanian sand at 10,340-48 and 10,356-62 ft. on 12/64-in. choke. On 14/64-in. choke it flowed 5,400 M.c.f.d. and 3 bbl. condensate per hour. On 11/64-in. choke it flowed 5,100 M.c.f.d. and 2 bbl. condensate per hour.

This is the east offset, second well, and confirmation to the field discovery, 1 Woodruff in C SW NE 4-15n-13w. That Morrow well flowed 7,210 M.c.f.d. and 336 bbl. condensate per day from Morrow at 10,220-40 ft. on 14/64-in. choke.

Arkoma basin gains another important gas discovery

Southeastern Oklahoma's Arkoma basin added another gas discovery at Humble Oil & Refining Co. 1 Nelson unit, C SE NW 18-9n-24e, LeFlore County, near shallow Cartersville field.

The well made open flow of 2,900 M.c.f.d. from perforations in the Spiro Pennsylvanian Atoka sand at 5,424-86 ft.

Midwest Oil Corp. tested gas in the Red Oak sand at 1 Goldsborough in SE SW NE 31-7n-23e, on the LeFlore County side of shallow Norris field, 4 miles northeast of similar production in Latimer County. The well flowed 2,710 M.c.f.d. from perforations at 7,032-42 ft.

Good well completed at Gulf Coast Amelia field

Potential is reported at the lower tubing completion of 3 Tyrrell-Combest in Amelia field, Jefferson County, Texas Gulf Coast. The Sparta Oil Co. and J. C. Barnes well flowed 61 M.M.c.f.d. plus 45 bbl. of condensate per day, gas-liquid ratio of 43,200:1, from perforations at 7,818-24 ft. in the lower Hackberry Oligocene. The upper tubing zone made oil from the Hackberry 2 sand perforations at 7,436-42 ft. No potential has been made here yet.

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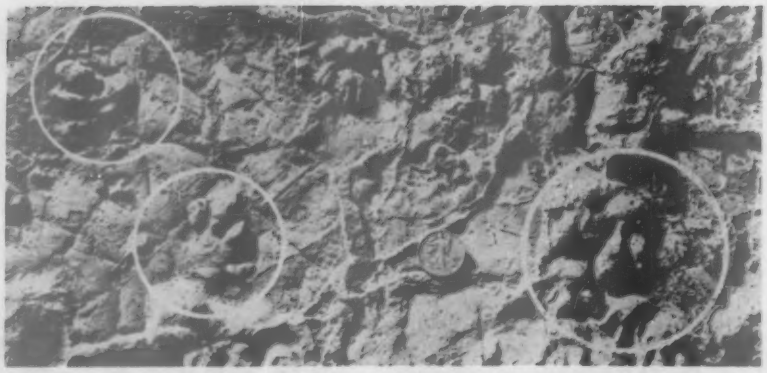

TRACKS of ancient mammals are circled on portion of slab presented to Smithsonian Institute.

TWO Shell Oil Co. geologists, H. D. Curry, left, and D. A. Preston, examine an Eocene slab found in the Uinta basin of Utah. This slab contains 90 mammal tracks.

Shell gives slab to Smithsonian

A ROCK SLAB containing 90 tracks of ancient mammals has been presented to Smithsonian Institute by Shell Oil Co.

H. D. Curry and D. A. Preston, Shell geologists, discovered the slab in Strawberry Canyon in the western part of Utah's Uinta basin. The tracks date back about 40 million years to the Eocene.

The slab, known as the Strawberry Slab, is housed in the newly completed Tertial Mammal Hall at Smithsonian. Samuel F. Bowlby, Shell's Pacific Coast area vice president, presented the gift to Dr. Leonard Carmichael, Smithsonian secretary, at a recent ceremony.

"We are able to present the slab because of Mr. Curry's alertness and his sense of responsibility for helping to increase scientific knowl-

group frac treatment of five flood producers gives 7-day payout

A waterflood operator boosted production 153 bopd by fracturing five wells. The cost of all five treatments was paid out with less than seven days production.

This story illustrates how Dowell engineers work with operators to help them boost profits and hold down operating costs.

Profits were boosted in this instance by using the Frac Guide* to design the treatments.

By carefully scheduling jobs, the operator was able to hold treatment costs down and take advantage of group treatment rates.

Pay was the El Dorado Shallow Sand in Butler County, Kansas. Depth ranged from 550 to 760 feet. Waterfrac was employed. 2600 gallons gelled water, 5000 pounds 20-40 mesh sand and 2000 pounds 10-20 mesh sand were used for each well. Average injection rate was 12.5 bpm.

Total oil production from the five wells before treatment was 21 bpd. Stabilized production of oil after treatment was 174 bpd . . . an 8-fold increase. Net sale price for oil was $3.00 per barrel.

Talk over your production problems with your Dowell man. Get his help in designing treatments to cut operating costs, boost production or both.

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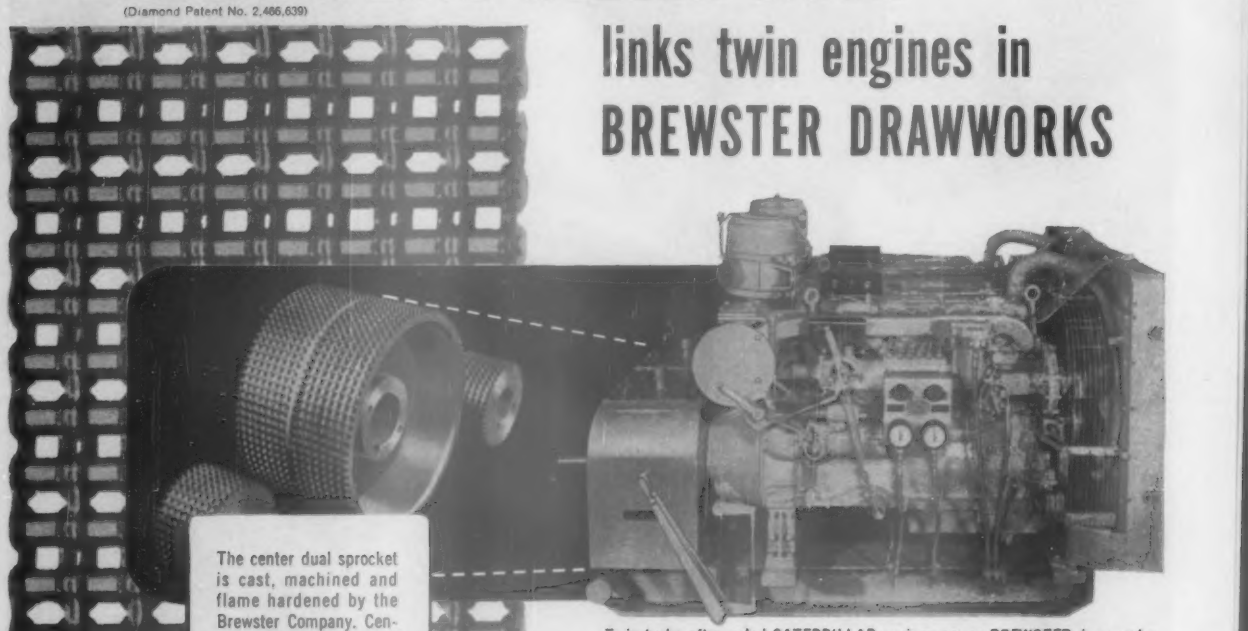

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edge," Bowlby said. "A less-perceptive oil geologist might have left the slab on the side of Strawberry Canyon."

Among the tracks on the slab are four different types of three-toe-mammals. Other tracks include those of a doglike animal, a smaller catlike animal with distinct claws, and tracks of birds. The slab weighs 1,000 lb. and is 8 ft. long.

SEG Foundation awards 30 scholarships

Thirty scholarships for studies in geophysics during 1961-62 have been awarded by the SEG Foundation, according to Maynard W. Harding, chairman of the foundation's scholarship administration committee.

More than $26,000 in scholarships will be awarded this year. Of this total, $2,000 will be awarded in foreign scholarships.

The foundation was established by SEG to sponsor study, teaching, and research in geophysics. Scholarship awards have been made each year since 1956.

The awards are made from a trust fund supported by contributions from companies and individuals interested in geophysical education. Thirty-two firms and individuals have made or pledged contributions this year in support of the 1961-62 scholarship program. In addition, a number of the members of SEG have contributed to the foundation's program.

Dual gas producer finaled in Zavala County, S. Texas

Southwest Texas has a new gas producer at W. J. Steeger et al. 1 Cross "S" Ranch, Inc., 7 miles north of Crystal City in Zavala County.

The Olmos and San Miguel dual producer flowed 9 M.M.c.f.d. from 2,667-74 and 2,680-86 ft., absolute open flow. From ¼-in. choke it made 1,494 M.c.f.d. From San Miguel at 3,340-54 ft. it flowed 12,500 M.c.f.d. On ¼-in. choke it made 1,987 M.c.f.d. The new field will be called either North Del Monte or Cross S. Closest Olmos production is ½ mile southwest at Del Monte field, separated by a fault. Location is in Section 12, Cross S Ranch Subdivision, Pedro Jose de Aguirre Grant.

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California well goes for deep pay

A TOTAL DEPTH of 17,440 ft. has been reached by Shell Oil Co., on a wildcat which will go down as the sixth-deepest hole ever drilled in California.

The company is preparing to run production tests on the 1 Sloan, which is located in 28-4n-18w in the South Piru area of Ventura County. Shell has hung a 7-in. string of casing to 16,805 ft.

A success at South Piru might kick off another deep-drilling play in California. However, deep drilling has not been particularly popular on the coast in recent years.

The last deep-drilling play hit a peak in 1955 when 14 wells were drilled below 15,000 ft. But the deep drilling fell off sharply when a series of dry holes turned up.

Too, producing some of the wells in the deep-drilling territory of Ventura County have proved costly.

There have been 38 wells drilled below 15,000 ft. since January 1, 1955, but only a few have been completed. The deepest completion was Richfield Oil Corp.'s 67-29 C.L.A. in North Coles Levee field, Kern County. This well was completed near total depth of 17,895 ft., but currently is producing from about 14,000 ft.

After the 14 deep wells were drilled in 1955, only four were drilled the following year. The number hit six in 1957, four again in 1958 and 1959, then up to seven last year. So far in 1961 only two other wells have gone below 15,000 ft. One of these is making hole at 15,072 on a redrill job.

During the 1955 deep-drilling spree, Ohio Oil Co. went to 21,482 ft. with its 72-4 "KCL A" in Paloma field. At the time, the Ohio well was the world's deepest hole.

Shell's well. The 1 Sloan is located about 2 miles northwest of Torrey Canyon field.

Production from the Lower Sespe pool in Torrey Canyon comes from an average depth of 9,725 ft. Eureka Canyon field, a shallow producer, is located about halfway between Torrey Canyon and the wildcat.

Rocky Mountain Drilling Co., Ventura, is contractor on the 1 Sloan.

CALIFORNIA'S 10 DEEPEST HOLES

Company, well—	Area	Depth, ft.
Ohio Oil, 72-4 KCL A	Paloma	21,482
Superior, 1 Limoneira	N. Montalvo	18,734
Richfield, 67-29 C.L.A.	N. Coles Levee	17,895
Standard of Cal., 1 Maxwell	Montalvo	17,696
Texaco, 1 Lawton	Fairview Canyon	17,485
Shell, 1 Sloan	South Piru	17,440
Standard of Cal., 1212 McGrath 4	W. Montalvo	17,422
Shell, 1 Sharp	Montalvo	16,915
Continental, 301 Grubb	S. Miguelito	16,727
Pacific Western, 1 National Royalties	Miramonte	16,668

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Three Sacramento gas tests abandoned

THREE IMPORTANT gas tests in California's Sacramento Valley have been abandoned as dry holes.

One of the three was the 1 O. P. Davis, a wildcat drilled by Occidental Petroleum Corp. in Section 29-15n-1w of Colusa County. The test is 1¾ miles northwest of West Grimes gas field, a six-well producer discovered by Occidental last year. Occidental took the 1 O. P. Davis to 8,980 ft. before plugging the hole.

In another Colusa County dry hole, Occidental drilled the most southerly test in Arbuckle gas field without finding commercial production. Occidental's 1 Arbuckle unit R went to a total depth of 6,850 ft.

The dry hole is 3,500 ft. south of Arbuckle production.

A ½-mile offset to one of the valley's biggest gas wells also has been completed as a dry hole.

McCulloch Oil Corp.'s 1 McCulloch-Soite in Section 17-2n-1w in Los Medanos field, Contra Costa County, had a weak blow of gas from perforations at 4,206-21 ft. The rate of flow was too small to measure.

The 1 Soirte is the easternly offset of the 1 Duarte, which was completed last December with an open-flow potential of 170 million cubic feet. The Duarte wells was completed in a 345-ft. Domengine sand section at 3,890-4,235 ft. The offset was taken to a total depth of 4,302 ft.

California wildcat staked

Pauley Petroleum, Inc., one of the successful operators in the tidelands off Santa Barbara County, California, is trying its luck at coming up with an on-shore discovery in the county.

The company has staked location for a 6,500-ft. wildcat, the 1 Pauley-Gila, in Section 4-4n-30w. The site falls just under a mile east of the limits of Capitan field and about ½ mile from two dry holes. The location is less than ½ mile inland from the coast.

Capitan is one of California's old coastal producing fields. The field averaged 210 bbl. daily from 46 wells last year. The Vaqueros formation is the principal producing pay in the field. The Vaqueros wells average 1,776 ft. in depth so the Pauley wildcat will be aimed at testing not only the Vaqueros, but three other deep pays in the area.

Pauley is one of the partners in a group which has made two discoveries off Santa Barbara County within the last 2 years. Phillips Petroleum Co. is group operator.

Open flow reported at western Oklahoma well

An open flow of 15 M.M.c.f.d. is reported at Huffman and Malloy 1 Carroll, NW SW SW 32-8n-16w, extension discovery in Southeast Rainey field, Washita County, western Oklahoma.

The well flowed gas from the Springer Pennsylvanian sand at 7,360 to 7,606 ft. Flow was 2,860 M.c.f.d. through ¼-in. choke with tubing pressure of 1,764 psi., 5,200 M.c.f.d. on ⅜-in. choke with 1,490-psi. tubing pressure.

DR. W. O. ROBERTS

SEG names keynote speaker

Keynoter for the thirty-first annual international meeting of SEG, November 5-9, 1961, in Denver will be Dr. Walter Orr Roberts, director of the National Center of Atmospheric Research, Boulder, Colo.

The theme of the meeting is "Exploration in a Changing World" and it is expected that Dr. Roberts will emphasize space exploration's contribution to a changing world.

Quadruple completion reported at Amelia in south coast area

A quadruple oil completion is reported in Amelia field, Jefferson County, Texas Gulf Coast. It is a Humble Oil & Refining Co. well in C. Williams Survey, A-59, 1 mile south of the town of Amelia on a 9.74-acre lease.

This is a no-tubing completion. Four separate strings of 2⅞-in. production casing were set separately in the well bore as follows: string 1 at 6,498 ft., No. 2 at 6,486 ft., No. 3 at 6,498 ft., and No. 4 at 6,486 ft. The No. 1 string comple-

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tion flowed 87 bbl. of 28.5°-gravity oil per day through 3/16-in. choke from perforations at 5,577-80 ft. The No. 2 string completion flowed 152 bbl. of 29.3°-gravity oil daily from Marginulina No. 4 perforations at 6,268-75 ft. through 7/64-in. choke. The No. 3 string flowed 124 bbl. of 28.4°-gravity oil per day through 7/64-in. choke from Fleming Z-4 sand at 5,459-60 ft., opening a new pay for the field. The No. 4 completion opened Frio 1-B sand production at 6,364-67 ft. This zone made 29.3°-gravity oil. Flow was 152 bbl. daily on ⅛-in. choke.

Workover in Houston area flows prolific gas from Miocene

A workover well in Clinton field, Harris County, Texas Gulf Coast, flowed 37 M.M.c.f.d. per day, dry gas. The well is Southern Oilwell Service 1 J. J. Oates, formerly F. M. Corzelius 1 Oates. The original well was an oil producer at 6,541-50 ft. back in 1948.

The new operator plugged back from the above zone, opening the 4,500-ft. Miocene zone at 4,496-4,504 ft. Flow was 37 M.M.c.f.d. Location is 5 miles northeast of Houston on a 17.6-acre lease in the Reels & Trobough Survey, A-59. Closest production is 1 mile northwest and northeast at Clinton Miocene field.

Colorado County. Marion Oil Co. of Tulsa opened a new dry gas pay in West Garwood field at 1 John R. McLane. The well flowed 10,200 M.c.f.d., absolute open flow. Perforations are at 3,836-40 ft.

West Texas oil field extended ¾ mile northwest

Northwest Ackerly-Dean field in Dawson County, West Texas, was moved ¾ mile northwest by Continental Oil Co.

The 1 J. Archer et al., 3 miles northwest of Ackerly town site, flowed 233 bbl. of 40°-gravity oil per day on 18/64-in. choke from perforations at 8,536-8,635 ft. Location of the well is in Section 45, Block 34, T&P Survey, T-4-N.

Also in Dawson County, Trice Production Co. finished up at 2 E. M. Dupree. This is the fifth well in the Dupree-Fusselman field, 8 miles northwest of Lamesa. It flowed 330 bbl. of 41°-gravity oil per day through 32/64-in. choke from perforations at 11,710-40 ft. Location is in Section 41, Block M, EL&RR Survey.

Ninety-foot pay reported at East Texas discovery

A new James lime discovery prospect in East Texas has 90 ft. of pay, reportedly cored at 9,835 ft. Atlantic Refining Co. is running production casing at 1 William E. Bruton in the Jose Juan Martinez Survey, A-993, 2¾ miles northwest of West Frankston field in southern Henderson County.

The hole is bottomed at 10,000 ft. The core began at 8,835 ft. Location is 4 miles northeast of Poyner, Tex. Nearest producer is Sun Oil Co. 1 Miller-Hurt on the Isaac Roberts Survey, A-658, 2 miles northeast of Poyner in West Frankston field. That well flowed 308 bbl. of 46°-gravity oil per day from James Lower Cretaceous perforations at 10,099-10,108 ft., West Panola. A Pettet discovery is re-

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In Pennsylvania, drilling with air, it is routine for one Reed Cobra bit to complete the hole from surface casing to TD. In this area total footage per Cobra bit regularly exceeds 7,000 feet.

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ported in western Panola County. It is W. R. Hughey 1 J. G. Sealey, an old dry hole worked over for completion of Pettet at 6,704-11 ft. The well flowed 87 bbl. of 42°-gravity oil daily through 20/64-in. choke. Location is in the Chris Barbee Survey, A-71, 10 miles west of Carthage and 3 miles west of Carthage field.

Pennsylvanian discovery finaled in Texas

A flowing Pennsylvanian oil discovery is reported by Gulf Oil Corp. in northeastern Ward County, West Texas. The well is 529 Hutchings Stock Association, 3½ miles southwest of Monahans on a 30,450-acre lease.

The well flowed 221 bbl. of 42.5°-gravity oil daily through 9/64-in. choke. Production is from perforations at 7,860-7,938, 7,960-84, and 8,012-40 ft. Location is in Section 70, Block N, G&MMB&A Survey, 1 mile northeast of 515 Hutchings Stock Association, an earlier 1961 Pennsylvanian discovery.

Yoakum County. Pan American Petroleum Corp. completed 1-A J. L. Gammon, 6 miles northeast of Denver City, southern Yoakum County. The well flowed 215 bbl. of 39.5°-gravity oil per day from Wolfcamp Permian perforations at 9,267-82 ft. Location is in Section 675, Block D, J. H. Gibson Survey, 1 mile northeast of Wasson field and 5 miles southeast of West Devonian field.

Discovery wells

WESTERN CANADA

Alberta:

British-American-Stanwell 4-28-21 Nevis, LSD 4, 28-39-21w4. Glauconitic gas discovery. TD 5,085 ft.

Shell-Baysell 14-16 Crossfield, LSD 14, 16-26-1w5. Cardium oil discovery. TD 8,040 ft.

NEW MEXICO

Eddy County:

Honolulu Oil Corp. 1 McKittrick Canyon unit, 6 miles southwest of Carlsbad in 25-22s-25e. IPCAOF 1 M.M.c.f.d., Morrow sand 11,203-88 ft. TD 12,292 ft. New gas discovery.

KANSAS

Decatur County:

Sauvage Drilling Co. Inc. 1 Lawson, C NE SW 11-1s-26w, 9½ miles south of Norcatur. IPP 85 BOPD, Reagan Cambrian sand 3,562-65 ft. TD 3,617 ft. New oil discovery.

Time Petroleum Co. 1 Crandell, C SW NE 10-4s-27w. IPP 25 BOPD, Lansing-Kansas City 3,593-99 ft. TD 4,100 ft. PB 3,620 ft. New oil discovery.

NORTH TEXAS

Archer County:

W. A. Lefton 1 J. R. Parkey "E" Gulf, ½ mile south of H.F.F. Caddo field in Dallas CSL Sur., A-113. IPF 192 BOPD, 10/64-in. choke, TP 780 psi., CP 895 psi., 42°, GOR 450:1, Mississippian open hole 5,270 ft. TD 5,279 ft. New oil discovery.

SOUTH TEXAS

Jackson County:

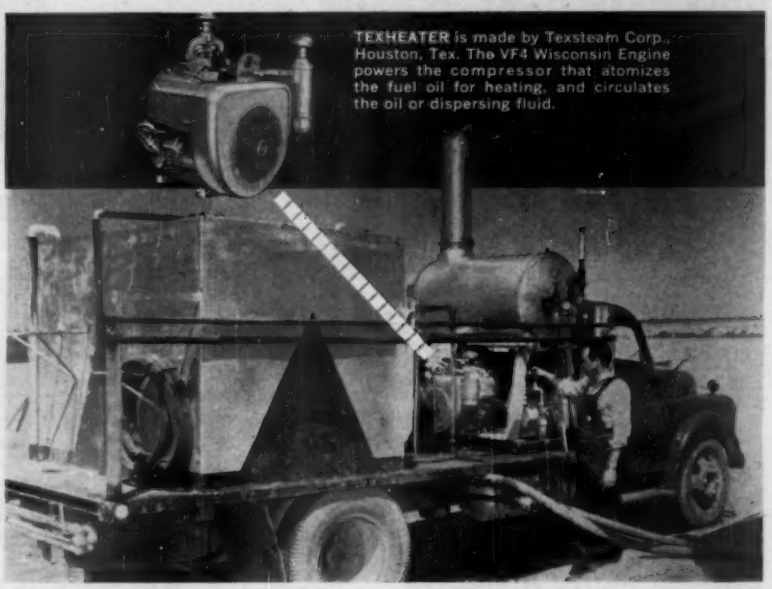
Welsh Oil & Gas Co. 1 George S. Gayle, 3 miles northeast of Edna in Nestor Clay Sur., A-13. IPAOF 10,800 M.c.f.d., SICP 2,211 psi., GLR 182,000:1, BHPSI 2,615 psi., 5,700-ft. Frio 5,697-5,702 ft. TD 6,346 ft. New gas-condensate discovery.

Jim Wells County:

South Little Rose. Trident Corp. 1 C. Hoelscher, 5 miles northeast of Alice in Los Presenos Abajo Grant, A-171. IPF 152 BOPD, no water, ⅛-in. choke, TP 1,050 psi., 34.2°, GOR 1,300:1, Bierstadt sand, 5,068-71 ft. TD 5,105 ft. New gas discovery.

Zapata County:

Blanco Oil Co. 1 T. C. and R. Jennings, 17 miles northeast of San Ygnacio in San Antonio de Mira Flores Grant. IPAOF 376 M.c.f.d., SICP 5,631 psi., HBPSI 7,108 psi., dry gas, Wilcox 10,052-62 ft. TD 11,700 ft. New gas discovery.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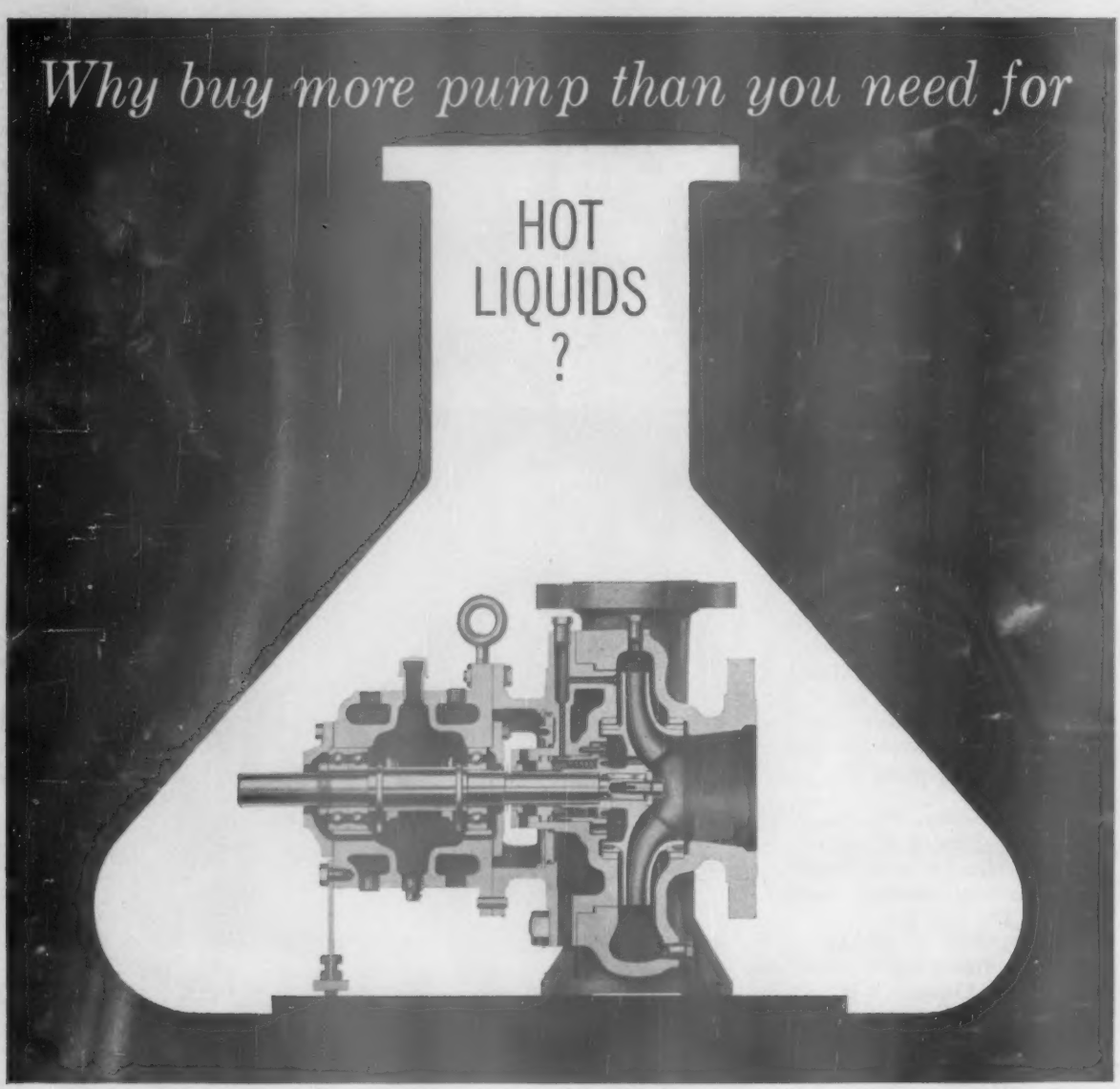

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• New group taps an old pro for president. More effective representation is seen as result of NPA-WPRA merger.

WHEN the two oldest petroleum associations merged last Wednesday, they picked an old pro for the first president.

Reid Brazell, new head of National Petroleum Refiners Association, has served his industry and his government well for over three decades.

Leonard Refineries, Inc., which he has headed since 1942, was an active member of both merging organizations—Western Petroleum Refiners Association and National Petroleum Association. Brazell himself was president of WPRA in 1955 and 1956.

Although he has been a Michigander for a quarter century, he hails from Oklahoma oil country. A native of Lamont, 15 miles west of Tonkawa, he attended University of Oklahoma graduating in 1927 as a chemistry major.

Continental Oil Co. took him on at the old Sapulpa refinery and later transferred him to Artesia, N. M. In 1930 he headed east, joining Allegheny-Arrow Oil Co. as assistant refinery superintendent at Canton, Ohio. Six years later, J. W. Leonard, Jr., lured him up to Alma, Mich., as refinery manager. By 1937 he was vice president and general manager.

While president of Leonard, he led in the negotiations which resulted in the merger of Mid-West Refineries, Inc., and Roosevelt Oil & Refining Corp. into Leonard, which survives as Michigan's leading independent refiner.

As an independent refiner, Brazell speaks with authority: "Both associations were founded by independent refiners who felt that the problems they faced were mutual problems and could best be solved by an association that could promote the general welfare of its members by dissemination of information relating to the refining industry, and providing communication between its members, the government and the public."

Although they began as regional organizations, said Brazell last week, both WPRA and NPA later became national in scope. The joint membership recognized that a single nation-wide organization could much more effectively deal with the refiners' problems.

Reid Brazell
. . . He knows his way around.

The new NPRA has 95 refiner members, most of them independents, and 20 associate members with a special interest in refining or transportation. The new structure has eight regional vice presidents and will maintain its joint staffs in Tulsa and Washington.

With this strength in depth, NPRA will give refiners a vital new representation. Brazell's fellow refiners have voted themselves aggressive leadership. He knows his way around, having held offices in World War II Petroleum Industry Committee, PAW, NPC, MPAB, API and IPAA.

●

Eight vice presidents have been elected by the new National Petroleum Refiners Association (see above). They are: **R. D. Bent,** Atlantic Refining Co., Philadelphia; **S. D. Breitweiser,** DX Sunray Oil Co., Tulsa; **Walter Famariss, Jr.,** Famariss Oil & Refining Co., Hobbs, N. M.; **L. E. Kincannon,** Rock Island Refining Corp., Indianapolis; **W. C. Norman,** Colorado Oil & Gas Corp., Denver; **G. A. Olsen,** Sunland Refining Corp., Fresno, Calif.; **L. W. Robbie,** Texas City Refining, Texas City; and **John E. Selden,** South Penn Oil Co., Oil City, Pa. Directors of the group will be **R. C. Adam,** Mobil Oil Co., New York; **Rexford S. Blazer,** Ashland Oil & Refining Co., Ashland, Ky.; **F. Kemmis Cadwell,** Union Oil Co., Los Angeles; **W. J. Carthaus,** Great Northern Oil Co., St. Paul, Minn.; **J. C. Ducommun,** American Oil Co., Chicago; **Donald Miller,** Skelly Oil Co., Tulsa; **R. W. McDowell,** DX Sunray, Tulsa; **Roland V. Rodman,** Apco Oil Corp., Oklahoma City; **R. C. Sauer,** Standard Oil Co. (Ohio), Cleveland; **Fred P. Sewell,** Delhi-Taylor Oil Corp., Dallas; **C. C. Tate,** Phillips Petroleum Co., Bartlesville, Okla.; and **R. L. Tollett,** Cosden Petroleum Corp., Big Spring, Tex. **Donald C. O'Hara,** NPRA general counsel, will head the group's Washington office. **Paul D. Williams,** secretary-treasurer, is in charge of the Tulsa office.

Dr. C. H. Gregory has been named New Orleans area geophysicist for Shell Oil Co. He succeeds **O. G. Holekamp,** recently transferred to Houston. **A. J. Bourgeois,** seismologist party chief, has been named New Orleans area seismologist.

Tyler F. Woodward will resign in September as director and president of Southern California Petroleum Corp. and its subsidiaries. Woodward helped found Southern California Petroleum in 1938 and has been chief executive officer for 15 years. He also founded three subsidiary companies, Camay Drilling Co., Camdrill International, Inc., and International Industrial Services.

W. G. Donley, assistant manager of Standard Oil Co. of California's economics department, has been appointed manager of the department. He succeds **Austin Cadle,** who has retired after 39 years with the company. **C. J. Carlton,** division supervisor of petroleum economics in the economics department, will succeed Donley as assistant manager. Donley has been with California Standard since 1943. He had been assistant economics manager since 1957.

▶▶▶ Personals

Russell H. Green, Jr., has been named manager of domestic exploration for Signal Oil & Gas Co. Green formerly was in charge of acquisition of producing properties. **Loring B. Snedden,** chief geologist, has assumed the added title of manager of California exploration. The following district geologists have been placed in charge of exploration in their districts: **Raymond A. Diemer,** Midland, West Texas; **Richard Bannister,** Houston, Gulf Coast; **John H. Larsen,** Casper, Rocky Mountains; **Robert J. McConville,** Calgary, Alberta; **Jack C. West,** Bakersfield, San Joaquin Valley; and **Andrew C. Alpha,** Los Angeles Basin. **Robert D. Reedy,** Sacramento geologist, has been named to represent Signal in the Sacramento Valley.

GREEN

E. H. Smoker, president of United Gas Improvement Co., Philadelphia, has been nominated for president of American Gas Association. Election will be held October 4 during AGA's annual meeting in Dallas. Others nominated for office include **John E. Heyke,** Brooklyn Union Gas Co., for first vice president; **Marvin Chandler,** Northern Illinois Gas Co., for second vice president; and **Charles H. Mann.,** Columbia Gas System, for treasurer. Nominated for directors are **D. S. Bittinger,** Washington Gas Light Co.; **H. A. Eddins,** Oklahoma Natural Gas Co.; **Walter T. Lucking,** Arizona Public Service Co.; **R. A. Puryear,** Alabama Gas Corp.; **J. F. Ray,** General Controls Co.; **R. J. Rutherford,** Worcester Gas Light Co.; **Judson S. Sayre,** Norge Sales Corp.; and **S. L. Sibley,** Pacific Gas & Electric Co. **Lester T. Potter,** Lone Star Gas Co., outgoing president of AGA, will automatically serve a 1-year term as director of the association next year. **E. F. Trunk,** Laclede Gas Co., has been nominated for chairman of AGA's operating section. **A. B. Lauderbaugh,** Manufacturers Light & Heat Co., has been nominated for first vice chairman, operating section, and **Jay Davis, Jr.,** Southern Counties Gas Co., has been nominated for second vice chairman.

Frank R. Faris has been named manager of crude-oil supply at La Gloria Oil & Gas Co.'s Tyler, Tex., refinery. He will continue to be active as a consultant on La Gloria's refined products sales activities.

Richard L. Davis, assistant superintendent of the light-oils division at the Whiting, Ind., refinery of Standard Oil Co. (Ind.), has been named assistant to Indiana Standard's executive vice president. He succeeds **Robert L. Gillis,** who has been named marketing director of Amoco Italia, Italian refining and marketing subsidiary.

R. B. Sublett, W. C. McBride, Inc., Evansville, Ind., has been elected 1961-62 president of Indiana - Kentucky Geological Society. He succeeds **Fred Forward,** Phillips Petroleum Co., Evansville. Other new officers inclule **Roscoe Wise,** Sun Oil Co., Evansville, vice president; and **John Avila,** Ryan Oil Co., Evansville, secretary-treasurer. Executive board members are **Frank Walker,** Kentucky Oil and Gas Division; **Art Pinsak,** Indiana Geological Survey; and Forward.

LeMoyne W. Myers has been named technical director and vice president of D. R. McCord & Associates, Inc., Dallas petroleum consultants. Myers was chief reservoir engineer for Socony Mobil Oil Co. in New York and assistant chief engineer for the Iranian consortium in Teheran before joining McCord.

James Q. Riordan, manager of Socony Mobil Oil Co.'s corporate planning and analysis department, has been named manager of the new corporate planning and economics department. The new department combines economics, special studies, and planning and analysis. **R. Russell Dickson, Jr.,** economics department manager, has been named assistant manager of the new department.

Christian A. Herter, Jr., a partner in Bingham, Dana & Gould, Boston law firm, will join Socony Mobil Oil Co. in September as adviser on government relations at the state, federal, and international levels. **Ray C. Hinman,** government adviser, will retire October 1 but will continue as a legislative consultant to Socony. **Edmund P. Hennelly** will be in charge of domestic government relations for the company. Herter has served the federal Government as general counsel of the Foreign Operations Administration, member of the State Department's policy-planning staff, and administrative assistant to the vice president of the United States. In Massachusetts he has been a member of the governor's council and a representative in the legislature.

HERTER

Charles S. Brewton, general counsel for the Senate small business committee, has been nominated by President Kennedy for assistant director of Office of Civil and Defense Mobilization for resources and production. He would succeed **J. Roy Price.** Brewton would be responsible for surveillance of government oil programs and long-range oil studies.

Abdullah al-Ukaili, Iraqi petroleum engineer, has been named to head the technical department of the Organization of Petroleum Exporting Countries. **Sharif Yusuf,** professor of Baghdad University, has been named head of OPEC's personnel department.

Charles W. Smith, director of Esso Research & Engineering Co.'s project-engineering division in Florham Park, N. J., has been named director of the process-engineering division. He succeeds **Maurice W. Mayer,** who has been given a special assignment as head of the company's engineering-recruitment program. **Daniel S. Borey,** assistant director of project engineering, has been named acting director of that division. **John G. Dunlap,** section head, has been named acting assistant director of project engineering.

▶▶▶ Personals

McGEE

Walter C. McGee, Jr., president of Tennessee Gas Pipeline Co., will take on additional duties as president of Midwestern Gas Transmission Co., a Tennessee Gas subsidiary. He will succeed **N. W. Freeman,** who is retiring from Midwestern for health reasons. Freeman will continue as a director of Midwestern.

Dr. Elton D. Soltes has been appointed general manager of Delhi-Taylor Oil Corp.'s gas sales and pipeline division. **Frank M. Coker** is manager of the pipeline department and **Leland Carter** is gas-contract attorney.

David L. Walters, engineer in Ohio Fuel Gas Co.'s right-of-way department, has retired after 32 years with the company. **Fred M. O'Leary,** plant foreman with Ohio Fuel Gas, has retired after 41 years of service.

William B. Threlkeld has been named assistant corporate secretary of Texas Gas Transmission Corp. He will continue as director of the company's land and lease department.

Harry B. Wood, executive vice president of United Natural Gas Co., has been elected president. He succeeds **J. G. Montgomery, Jr.,** who retired July 1 after 36 years with United Natural and its affiliates. Wood will also succeed Montgomery as president of Mars Co., Sylvania Corp., and as a director of National Fuel Gas Co., the parent company. Montgomery will continue as a consultant to National Fuel Gas.

Walter A. Myrick III, assistant superintendent of El Paso Gas Products Co.'s Odessa, Tex., styrene plant, has been named superintendent. **J. John Mills,** assistant plant superintendent in engineering and petrochemical developments, has been promoted to coordinator. **James P. Watson,** process supervisor at the Ciniza refinery, Gallup, N. M., has been named assistant plant superintendent there. **Samuel B. Norris,** lubrication oil supervisor in El Paso, Tex., has been named staff engineer. **Jack B. Mace,** lubrication engineer, has been named lubrication oil supervisor. **N. A. Wright,** engineer at the Odessa ethylene plant, has been named production supervisor there.

C. H. Nelson has been promoted to economics analyst on Gulf Oil Corp.'s domestic manufacturing department staff in Houston. Nelson had been supervisor of the economics section of the Port Arthur, Tex., refinery's planning and economics division. He has been with Gulf since 1952.

J. E. Cordell, Shreveport, La., has been transferred by Pan American Petroleum Corp to Jackson, Miss., where he will be district engineer. **L. G. Donovan** has moved from Shreveport to Jackson as district services supervisor. Pan Am recently combined its Shreveport and Jackson district offices under headquarters in Jackson.

H. Wilkinson, a managing director of the Royal Dutch-Shell companies and of Shell Transport & Trading Co., Ltd., has been elected a director of Shell Oil Co. He succeeds **F. J. Stephens,** who has resigned to become chairman of Shell Transport & Trading. Wilkinson has been with the Royal Dutch-Shell companies since 1922. He was president of Asiatic Petroleum Corp. in New York from 1936 to 1953 except for a period during World War II when he served as official petroleum representative in Washington for the British government. He became president of Canadian Shell Ltd. (Toronto) in 1953. Since 1957 he has had appointments as a managing director of Shell Petroleum Co., Ltd., a principal director of Bataafsche Petroleum Mij., chairman of Shell Tankers, Ltd., and managing director of Shell Transport & Trading.

WILKINSON

Raymond M. Thompson, Denver consultant, has been named exploration manager for the Rocky Mountain division of Eason Oil Co. of Oklahoma City.

Robert W. Hines, Texas Pacific Coal & Oil Co.'s vice president for production, has been elected executive vice president. Hines joined Texas Pacific in 1954 as assistant manager of production. He became production manager and a director of the company in 1957 and vice

(Personals continued on Page 216)

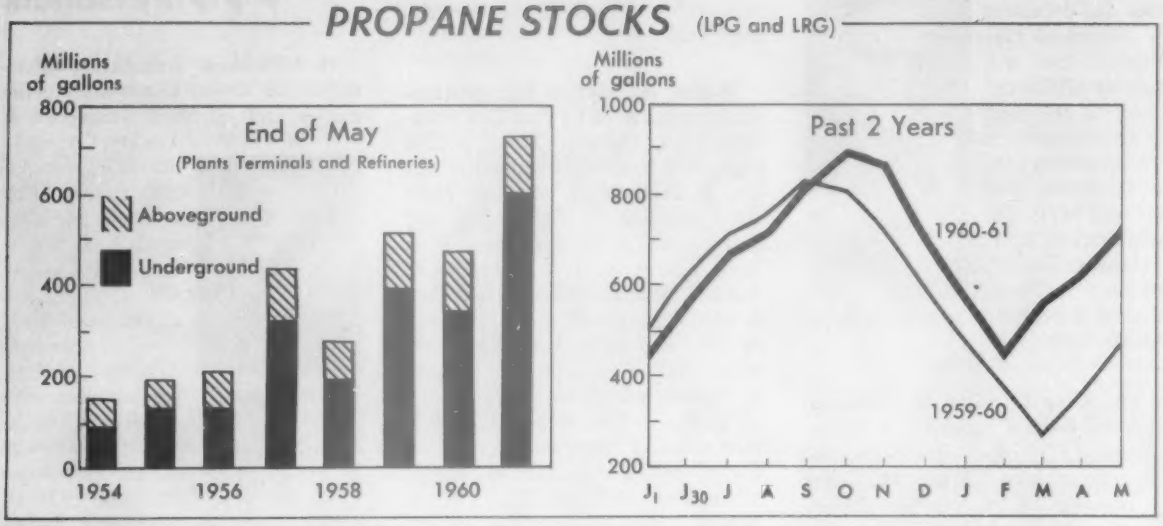
▶▶▶ Deaths

Joseph R. Hall, 66, retired Oklahoma oil production superintendent for Texaco, died June 24 at his home in Tulsa of a lung ailment. Hall retired last year after 44 years with Texaco.

Jack Jordan Ammann, 52, president and chairman of Jack Ammann, Inc., San Antonio, Tex., aerial survey company, died June 14 at his home in San Antonio. Ammann was a partner in Kargl Aerial Surveys before setting up his own company in 1940.

John B. Merritt, 73, retired field superintendent for Honolulu Oil Corp. and owner of Merritt Brothers Oil Co., died June 17 in a Bakersfield, Calif., hospital after a long illness. After his retirement from Honolulu, Merritt and his brother, the late James C. Merritt, formed the Merritt Brothers producing firm.

Raymond L. Wyatt, 36, district engineer for Tenneco Oil Co. in Casper, Wyo., died June 7 after a long illness. Wyatt was with Tenneco in Wichita Falls, Tex., before moving to Casper. He also was with Pan American Petroleum Corp. in Louisiana and Oklahoma at one time.



Propane stocks climb; prices are soft

BY JOHN C. CASPER

PROPANE STOCKS set a new May record this year. The total at the end of the month was 732 million gallons, including 605 million underground.

This record backlog of propane has increased the seasonal pressure on spot prices. The Group 3 price is down to 2.5-3 cents, and the outlook is a little gloomy. The earliest possible stock reduction is at least 5 months away.

If operators increase stocks over the next 5 months as they did in the same period last year, the end-of-October total will be up to 1.15 billion gallons, and that total covers just propane. It will take some detailed planning to find space for all of the propane produced between now and the end of October.

The small table at the bottom of the page furnishes a clue to the high stock level. The most important factor was the puny stock reduction in the first quarter. Lines on the right chart show that most of the stock shift came in March when operators added 110 million gallons to propane inventories. This was the first time in recent years that propane stocks gained more in March than in May.

This big March increase restricted the over-all drawdown for the first quarter to 142 million gallons compared with an average first-quarter drop of 281 million for the three preceding years.

Bars on the left chart give a picture of propane stocks at the end of May each year since 1954. The average annual increase for the 7-year period has been better than 25%. This gain rate cannot continue in the years ahead.

There are several reasons why additions to propane stocks will have to slow down. First, stocks have been growing faster than demand. As long as propane had to be stored in steel pressure tanks, the cost factor limited inventory accumulation. Marketing patterns changed with availability of underground storage.

Stocks may climb to a billion gallons this fall. If the 25% gain rate were to continue until 1970, propane stocks would be up to 7.6 billion gallons. And, expected income from sales would not support that much stock accumulation.

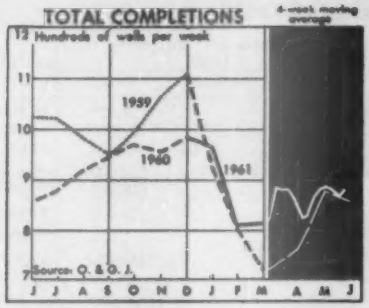
CHANGE IN PROPANE STOCKS
(Millions of gallons)

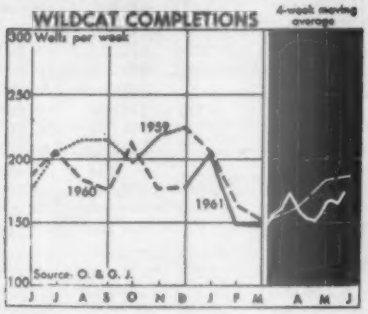
	1958	1959	1960	1961
Jan.	−153	−204	− 98	−190
Feb.	−145	− 63	− 95	− 62
Mar.	− 13	58	−131	110
Apr.	65	72	90	59
May	98	123	114	108
June	92	111	99	...
July	74	94	111	...
Aug.	92	46	32	...
Sept.	65	64	105	...
Oct.	50	− 8	75	...
Nov.	51	− 91	− 20	...
Dec.	−165	−134	−164	...

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,930,275	DOWN	160,975	DOWN	15,079
Crude stocks	257,542,000	UP	633,000	DOWN	1,415,000
Completions	953	UP	3	UP	14
Refinery runs	7,865,000	DOWN	359,000	DOWN	366,000
Gasoline stocks	203,399,000	DOWN	4,283,000	UP	157,000
Kerosine stocks	29,580,000	UP	369,000	UP	1,997,000
Distillate stocks	105,956,000	UP	3,290,000	DOWN	931,000
Residual stocks	46,091,000	UP	916,000	UP	5,499,000
Four-product stocks	385,026,000	UP	292,000	UP	6,722,000
Total imports	1,548,600	UP	43,400	DOWN	77,500

Active Rotary Rigs





	6-26-61	6-19-61	6-27-60
Alabama	3	3	4
Alaska	10	10	4
Arkansas	13	13	14
Arizona	2	2	1
California	65	66	87
Land	62	61	81
Offshore	3	5	6
Colorado	34	34	29
Florida	0	0	2
Land	0	0	2
Offshore	0	0	0
Georgia	1	1	0
Illinois	49	41	39
Indiana	7	8	9
Iowa	1	1	0
Kansas	113	107	120
Kentucky	5	4	4
Louisiana	279	287	295
North	22	27	36
S. Inland waters	113	110	110
S. Land	86	90	93
Offshore	58	60	56
Michigan	25	29	44
Mississippi	60	61	58
Missouri	3	2	2
Montana	22	24	17
Nebraska	36	37	28
New Mexico	102	103	114
New York	1	1	0
North Dakota	17	16	16
Ohio	8	6	6
Oklahoma	201	193	192
Pennsylvania	5	7	13
South Dakota	0	1	0
Texas	617	655	574
S. Inland waters	7	6	4
S. Land	183	187	168
Offshore	3	7	1
North	56	60	55
Panhandle	51	49	41
East	62	76	56
West Central	145	161	156
West	110	109	93
Utah	27	26	29
Virginia	0	1	0
Wasnington	0	1	0
West Virginia	8	7	5
Wyoming	59	55	65
Total U. S.	1,773	1,802	1,771
Cum. avg. to date	1,649	1,644	1,739
Western Canada	168	163	155
Eastern Canada	1	1	2
Grand total	1,942	1,966	1,928

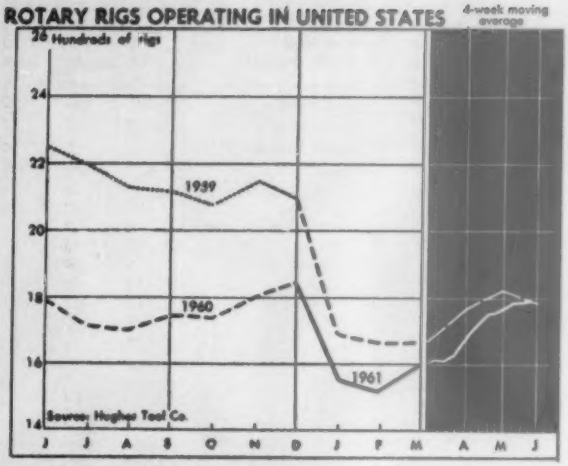
Hughes Tool Co. report.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED JUNE 24, 1961

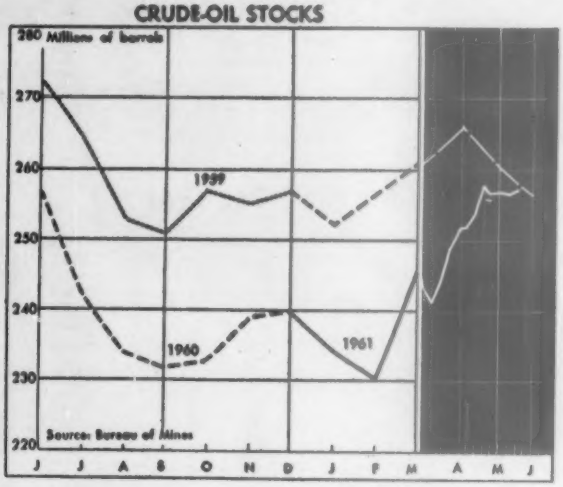
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Alabama	0	0	0	0	0	0	0	29	25	0	0	0	0	0	6	1
Alaska	2	2	0	0	0	0	22,239	20	...	0	0	0	0	0	2	...
Appalachian	21	8	0	10	3	0	63,787	933	828	1	0	0	0	1	30	33
Arizona	0	0	0	0	0	0	0	12	8	0	0	0	0	0	7	8
Arkansas	6	1	0	1	4	0	23,134	243	293	2	0	0	0	2	47	76
California	0	0	0	0	0	0	0	784	690	0	0	0	0	0	128	137
Colorado	7	0	0	0	7	0	26,060	291	298	4	0	0	0	4	145	143
Illinois	35	16	0	2	17	0	74,602	846	963	11	1	0	1	9	171	221
Indiana	11	3	0	0	8	0	19,721	297	452	2	0	0	0	2	86	172
Kansas	128	55	0	9	51	13	280,039	2,579	1,588	17	4	0	0	13	465	520
Kentucky	52	13	0	18	20	1	85,268	709	762	0	0	0	0	0	76	90
Louisiana	73	34	3	7	29	0	488,887	1,765	1,632	16	1	0	0	15	282	249
North	42	13	0	5	24	0	143,391	654	554	14	0	0	0	14	122	112
South	24	14	3	2	5	0	265,300	848	821	2	1	0	0	1	134	120
Offshore	7	7	0	0	0	0	80,196	263	257	0	0	0	0	0	26	17
Michigan	31	11	0	1	18	1	91,759	335	361	12	0	0	0	12	132	108
Mississippi	16	5	1	1	9	0	150,547	271	354	7	0	0	0	7	89	124
Montana	5	3	0	0	2	0	16,835	170	139	2	0	0	0	2	77	64
Nebraska	20	8	0	0	12	0	90,595	464	384	14	3	0	0	11	205	150
New Mexico	36	17	0	10	8	1	189,851	849	888	6	2	0	0	4	150	130
West	18	3	0	10	5	0	81,864	373	289	2	0	0	0	2	52	28
East	18	14	0	0	3	1	107,987	476	599	4	2	0	0	2	98	102
North Dakota	4	4	0	0	0	0	21,524	119	147	0	0	0	0	0	31	34
Ohio	20	9	0	2	6	3	43,051	492	493	1	0	0	0	1	22	27
Oklahoma	173	80	1	13	43	36	487,735	2,878	1,890	15	5	0	2	8	293	372
Texas	294	122	12	17	131	12	1,258,803	6,958	7,716	73	7	2	1	63	1,413	1,540
District 1	22	4	0	0	18	0	43,505	429	524	14	0	0	0	14	168	194
District 2	30	11	6	2	11	0	189,677	349	370	6	0	2	0	4	77	88
District 3	19	6	1	1	11	0	132,782	521	592	5	0	0	0	5	104	111
District 4	27	12	0	5	10	0	118,905	613	524	3	0	0	0	3	126	152
East	37	18	1	0	18	0	179,093	603	614	12	2	0	0	10	144	128
District 7-B	27	12	0	1	12	2	73,326	955	1,116	10	1	0	0	9	256	315
West	53	26	3	1	22	1	245,239	1,712	2,055	16	3	0	0	13	372	318
District 9	58	25	0	0	26	7	165,508	1,173	1,429	5	1	0	0	4	120	201
District 10	21	8	1	7	3	2	110,768	603	489	2	0	0	1	1	46	33
Utah	4	1	0	2	1	0	14,827	121	130	2	0	0	1	1	49	44
Wyoming	13	6	0	1	6	0	62,802	457	481	5	0	0	0	5	173	204
Misc. (Wash.)	2	0	0	0	2	0	7,065	92	68	2	0	0	0	2	90	53
Total U. S.	953	398	17	94	377	67	3,519,131	21,714	20,590	192	23	2	5	162	4,169	4,500
Total prev. week	950	441	26	75	349	59	3,911,015	...	...	173	18	2	8	145	...	...
Cum. 1961	21,714	9,857	480	2,102	7,799	1,476	87,496,328	...	...	4,169	342	50	190	3,587	...	...
Cum. 1960	20,590	9,707	641	1,644	8,005	593	90,072,613	...	...	4,500	400	50	147	3,903	...	...
Western Canada	40	25	0	8	7	0	213,592	999	1,005	4	1	0	2	1	278	290

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	6-17-61	6-10-61	6-18-60
Pennsylvania	2,389	2,381	2,132
Other Appalachian	1,734	1,680	1,714
Illinois, Indiana, Michigan	10,296	10,376	10,367
Nebraska and North Dakota	3,212	3,095	2,716
Kansas	10,077	10,032	9,875
Oklahoma	16,548	16,549	18,543
Arkansas	2,097	2,143	1,870
Louisiana	22,472	21,210	19,296
North	3,607	3,527	2,905
South	18,865	17,683	16,391
Mississippi, Alabama, Florida	2,126	2,357	2,094
New Mexico	8,122	8,052	8,022
Texas	107,809	107,537	108,530
East Texas	9,047	9,470	8,591
West Texas	47,854	47,675	49,156
Texas Gulf	19,610	19,654	19,383
Other Texas	31,298	30,738	31,400
Wyoming	19,395	19,507	17,883
Other Rocky Mountain	10,132	9,785	10,263
California	25,319	25,395	28,773
Foreign	†15,814	16,810	16,879
Total	257,542	256,909	258,957

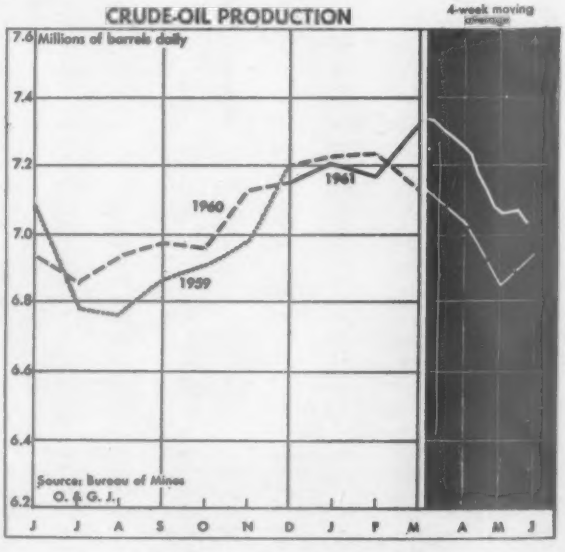
*Bureau of Mines. †Includes 3,953,000 bbl. in California.

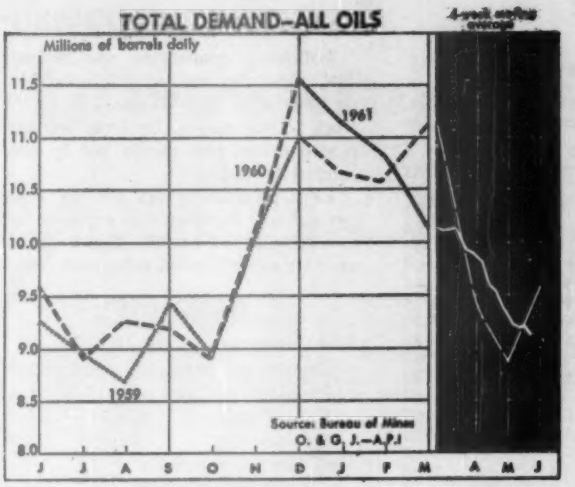
DAILY AVERAGE PRODUCTION FOR WEEK

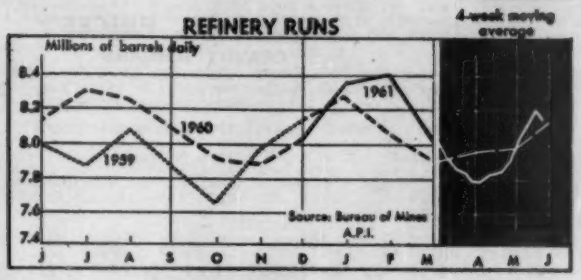
	June 24, 1961			June 17
	Crude oil	Lease condensate	Total	total
Alabama	19,325	.....	19,325	19,300
Alaska	19,000	.....	19,000	14,500
Arkansas	75,440	60	75,500	81,025
California	822,500	.....	822,500	822,500
Colorado	128,000	.....	128,000	129,200
Eastern	38,400	.....	38,400	37,900
Florida	1,050	.....	1,050	1,050
Illinois	210,500	.....	210,500	217,800
Indiana	30,200	.....	30,200	31,000
Kansas	†309,300	.....	†309,300	†305,250
Kentucky	48,400	.....	48,400	49,300
Louisiana	977,325	133,500	1,110,825	1,159,800
North	106,325	5,000	111,325	110,300
South	871,000	128,500	999,500	1,049,500
Michigan	51,000	.....	51,000	50,800
Mississippi	141,200	3,700	144,900	149,900
Montana	84,000	.....	84,000	82,900
Nebraska	67,700	.....	67,700	70,100
Nevada	450	.....	450	450
New Mexico	291,800	6,800	298,600	314,800
North Dakota	57,600	.....	57,600	51,000
Oklahoma	†501,600	.....	†501,600	†511,200
Texas	2,333,000	89,600	2,422,600	2,499,600
Dist. 1	43,000	2,300	45,300	45,300
Dist. 2	99,000	8,100	107,100	107,100
Dist. 3	276,000	37,000	313,000	346,000
Dist. 4	175,000	12,500	187,500	187,500
Dist. 5	26,000	500	26,500	26,500
Dist. 6	106,000	8,200	114,200	114,200
East Texas field	128,000	.....	128,000	128,000
Dist. 7-B	121,000	250	121,250	121,250
Dist. 7-C	110,000	3,150	113,150	113,150
Dist. 8	970,000	12,000	982,000	1,009,000
Dist. 9	176,000	3,400	179,400	196,400
Dist. 10	103,000	2,200	105,200	105,200
Utah	98,000	.....	98,000	98,500
Wyoming	390,100	.....	390,100	392,600
Others	‡725	.....	‡725	‡775
Total U. S.	6,696,615	233,660	**6,930,275**	7,091,250
Change from prev. week, down			**160,975**	.....
Canada	†635,900	.....	†635,900	†626,200
Total U. S. prod.—Jan. 1-June 24				1,264,937,300 bbl.
Same period last year (crude plus cond.)				*1,245,069,500 bbl.

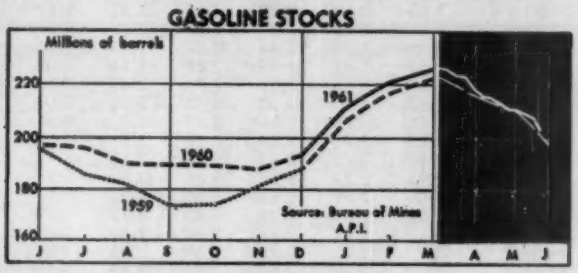
*Includes 40,744,600 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona.

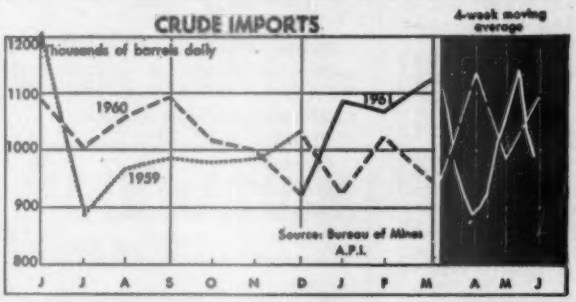
CRUDE-OIL PRODUCTION

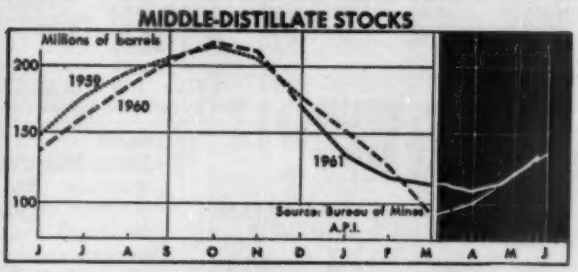


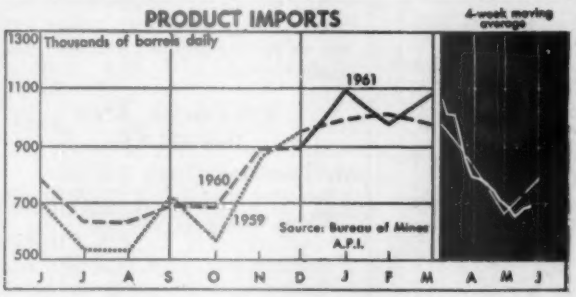


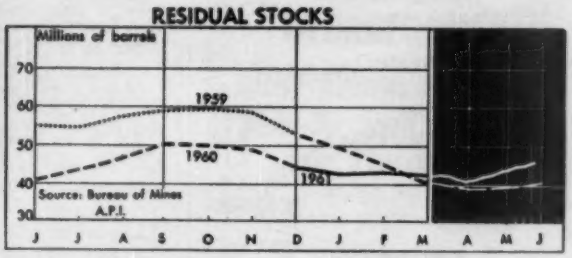












API REFINERY REPORT—JUNE 23, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, June 1960 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,007	446.4	38.7	266.0	123.1	46,359	11,009	31.562	10,543	1,128	528.9	34.2	325.7	146.4
Appalachian:														
District 1	102	44.9	2.0	24.9	8.3	5,848	591	2,343	374	96	41.2	2.7	21.7	7.7
District 2	89	38.1	4.3	9.4	10.7	2,823	353	971	196	90	46.6	2.1	16.3	8.5
Ind., Ill., Ky.	1,320	729.6	56.6	286.7	116.6	35,184	4,941	18,257	5,382	1,455	774.4	66.7	301.8	128.0
Minn., Wis., Dak.	129	61.8	4.4	33.6	19.6	7,106	817	4,355	713	128	62.3	5.3	32.8	14.6
Okla., Kans., Mo.	771	440.6	18.1	166.7	19.9	17,774	1,488	10,411	955	751	422.7	17.5	175.7	21.0
Inland Texas	322	222.7	13.7	57.0	19.9	7,418	556	1,570	2,662	304	223.5	10.0	49.8	22.4
Texas Gulf Coast	1,734	865.6	98.7	379.0	93.9	30,527	4,064	14,289	5,031	1,967	1,007.0	95.5	462.6	141.8
La. Gulf Coast	706	350.7	36.9	148.3	48.1	11,171	2,847	4,902	1,445	653	329.2	45.0	136.5	41.6
N. La. and Ark.	123	65.3	3.6	26.0	7.4	5,168	808	1,724	133	112	64.5	4.9	24.4	5.6
Rocky Mountain:														
New Mexico	21	11.0	0.4	3.7	2.1	581	56	177	38	24	13.2	0.3	4.3	2.2
Other Rocky Mt.	305	140.0	2.3	64.0	31.4	7,437	515	2,698	983	275	132.9	3.7	63.2	27.8
West Coast	1,236	479.7	45.4	220.3	269.7	26,003	1,535	12,697	17,636	1,143	513.7	37.4	163.2	275.7
June 23, 1961	7,865	3,896.4	325.1	1,703.6	770.7	203,399	29,580	105,956	46,091	8,126	4,160.1	325.3	1,778.0	843.3
June 16, 1961	8,224	4,387.7	330.7	1,820.7	832.0	207,682	29,211	102,666	45,175	.....	.....	.....	.....	.....
June 24, 1960	8,231	4,150.7	317.6	1,812.6	872.3	203,242	27,583	106,887	40,592	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	...	...	...	...	...	...	...	...
15-15.9	1.93	...	...	...	...	...	...	...	$1.81
16-16.9	2.00	...	...	...	...	...	...	...	1.86
17-17.9	2.06	...	...	...	...	...	...	...	1.91
18-18.9	2.13	...	...	...	...	...	...	...	1.96
19-19.9	2.20	...	(†)	...	...	...	...	...	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	...	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	...	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	...	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague. †Two buyers announced increase.

FLAT PRICES

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.80
- Middle District 4.52
- Southwest Pennsylvania 4.25
- West Virginia 4.17
- Breckenridge 4.0

Illinois Basin **3.00-3.05**

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)
- Arabian, 34.0°-34.9°, Ras Tanura $1.80
- Iranian, 34.0°-34.9°, Bandar Mashur 1.78
- Iranian, 34.0°-34.9°, Abadan 1.73
- Iraq, 35.0°-35.9°, Fao 1.72
- Kuwait, 31.0°-31.9°, Mina-al-Ahmadi 1.59
- Qatar, 41.0°-41.9°, Umm said 1.95

Middle East, E. Mediterranean:
- Arabian, 34.0°-34.9°, Sidon $2.17
- Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli 2.19

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 36° 2.42

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Weyburn (light) 2.075
- Midale C 1.70

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long Ton)

(Latest reported spot fixtures)

- ★ Carib.-NY, dirty (ATRS—60%) $1.10
- ★ Carib.-UK, dirty (Scale—65%) (11s. 5d.).. 1.60
- ★ Gulf-NY, clean (ATRS—7.5%) 2.64
- ★ Gulf-NY, dirty (ATRS—10%) 2.57
- ★ PG-Japan, dirty (USMC—71%) 2.96

★ Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):
- Regular (91 octane) ... 12.25-12.50
- Premium (99 octane).. 15.00-15.25
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 10.75-11.00
- Regular (92 octane) .. 11.00-11.25
- Premium (98 octane). 12.00-12.25

California (rack) Los Angeles:
- Regular (90 octane) 11.60
- Premium (94 octane) 12.60
- Premium (100 octane) 14.10

Caribbean area (cargoes):
- Regular (87 octane) 9.125
- Premium (97 octane) 11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):
- Kerosine 42-44 ..... 9.50-9.75
- Diesel oil (58 d.i. and above) 9.00-9.25
- Distillate No. 1 ..... 9.00-9.25
- Distillate No. 2 ..... 8.25-8.50

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 9.00
- Distillate No. 2 ..... 8.25

New York Harbor (barges):
- Kerosine 42-43 ..... *11.40
- Distillate No. 2 ..... *10.40
- Diesel fuel, 48-52 d.i. *10.55

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.625

*Subject to 0.5 cent discount.

RESIDUAL FUEL (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.65-1.75

Gulf Coast (cargoes):
- Bunker C fuel 2.20-2.30

New York Harbor (barges):
- Bunker C fuel 2.52

Caribbean (cargoes):
- Bunker C fuel 2.00

California (rack):
- Bunker C fuel, Los Angeles 2.25

Classified Advertising

. . . your market place for the oil and gas industry

RATES:

- UNDISPLAYED CLASSIFIED: 30c a word per issue. 10% discount for three or more consecutive issues. $5.00 minimum charge. Blind box in our care count nine extra words. Not subject agency commission.
- DISPLAYED CLASSIFIED: $20 a column inch one issue. 10% discount three or more consecutive issues. Minimum size one inch. Subject to agency commission.
- All classified payable in advance.
- DEADLINE: Copy to reach The Oil and Gas Journal not later that 9 a.m. on Wednesday preceding date of publication. Send advertisements to: Classified Advertising Manager, THE OIL AND GAS JOURNAL, P. O. Box 1260, Tulsa 1, Oklahoma.

EXCEPT . . .

WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona). Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Mariton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287. Copy deadline Monday noon.

FOR SALE EQUIPMENT

3 BIGELOW BOILERS, Scotch type, 200 pounds working pressure, horizontal, complete with all controls. In service approximately five years. Steel frame boiler building, 82' long by 32' wide. Direct inquiries or bids to Box M-455, The Oil and Gas Journal, Tulsa, Oklahoma.

Buying Good Used Equipment

is frequently the difference between having needed equipment or doing without it.

LIQUIDATION

at ESSO REFINERY Balto., Md.

MOST EQUIPMENT NEW 1956

TOWERS—30" to 84" diameter, 20' to 97' high, 7 to 34 trays, up to 360 PSI

DRUMS—3' to 12' diameter, 12' to 45' long to 530 PSI, some lined—some NEW

PETRO-CHEM FURNACES—30.7; 19.3; 10.4; 9.7; 7.5; 2MM BTU/Hr.

NEW FURNACE TUBES—4000'—3/8" & 1/2" Wall Croloy 5—4" to 6"

PUMPS—88 to 400 GPM up to 2040' head—up to 8 Stage

HEAT EXCHANGERS—CONDENSERS

Stainless Tubes —235 to 2320 Sq. Ft.
Croloy 5 Tubes —573 to 1040 Sq. Ft.
Admiralty Tubes —216 to 1640 Sq. Ft.
Steel Tubes —238 to 2240 Sq. Ft.

COMPRESSORS & BLOWERS

510CFM @ 500PSI Non-Lubricated 350 HP (3)
7500CFM @ 42.5PSIG, 1250HP Synch.

WRITE FOR CATALOG

HEAT & POWER CO., INC.

60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa, Okla.
Boston & Haven St.. Baltimore 24, Md.

FOR SALE EQUIPMENT

USED QUICK-CYCLE hydrocarbon Recovery and Gas Dehydration Units: 12MM to 30 MM SCFD capacities at 1000# W.P.—turnkey installation. Other used gas processing equipment available including gas dehyrators, glycol type. Two Used 10' x 22½' x 50# W.P. Emulsion Treaters with New 1.0 MM BTU/Hr. Firetubes and New Valves and Accessories. Engineered Specialties Co., Box 35683, Phone FL 1-5284, Dallas 35, Texas.

SURPLUS PIPE FOR SALE

2900' 2⅞" Amer Open Hole Drill Pipe W/ 3⅞" Bottle Neck T. J. Inspected. 3500' 3½" I.F. Inspected W/ 4⅛" T. J. Square Shoulder. 11,800' 3½" I.F. Inspected W/ 4½" T. J. Bottle Neck. 4000' 4½" FULL & X Hole Inspected W/ 5⅞" T. J. Bargain Priced.

Write or Call
Don Harman Pipe Supply
Phone OR 7-4343 Oklahoma City, Okla.

AT N. LITTLE ROCK, ARKANSAS

3—Worthington #LTC-4 compressors, 3500 CFM @ 45 PSI, 24 x 15, 2-cyl., 500 HP, 4-cycle. gas-engine drive.

Phone POplar 3-3505

PERRY EQUIPMENT CORP.
1402 N. Sixth St.
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FOR SALE
2,500 BBL. OIL REFINERY
Located Near Escanaba, Michigan

Unrestricted supply of western Canadian Crude Oil from Lakehead Pipeline. 25 acre site. 100,000 bbl. Storage Facility, Fractionating Tower, Naptha Tower, Asphalt Tower, Exchangers, Pumps, Piping, etc. Plant processed Gasoline and Fuel Oils. Facilities available for production of Asphalt, Naptha, Jet Fuel, etc.

VERY ATTRACTIVELY PRICED
Box M-454, The Oil and Gas Journal
Tulsa, Oklahoma

One Vertical Direct Fired Water Heater

Radiant with separate convection section, 2.04 MM BTU/HR Heat Absorption Rating, 14,600 LBS/HR Charge Rate, 140° F. temperature differential, 95 PSIG Inlet Pressure, Series 300 ASA Flanges, Natural Gas Burner, ASTM-106B Sched. 40 Carbon Steel Tubes, 6'-0" OD x 10'-6" high to Bottom Stack.

One Vertical Convection Crude Oil Heater

Radiant Integral Two-Pass 5.35 MM BTU/HR Heat Absorption Rating, 135,310/11,181 LBS/HR Charge Rate of 21° API/18 M.W. Crude, 150/220° F. Inlet/Outlet Temperature, 102 PSIG Inlet Pressure, Ohio 1000 Series 850 Cleanout Headers, Natural Gas Burners, ASTM A-161 Carbon Steel Tubes, 7'-3" OD x 23'-0" high to Base of Stack.

NEW—Specially priced for immediate sale.

Address requests for prices or additional information to:

Box M-435, The Oil and Gas Journal
Tulsa, Oklahoma

FOR SALE EQUIPMENT

FRED E. COOPER deep-hole workover unit, complete with Lee 87' telescoping derrick, 187,000 lb. hook load, hydraulic tongs and air slips. Practically new. One Bucyrus-Erie 48L spudder, complete with rod and tubing tools. Write: G. H. Turpin, 306 Austin, Borger, Texas—or phone: BR 3-5551.

Sales—GAS COMPRESSORS—Rentals

Save 25% to 40% over new price
Used 30 h.p. to 300 h.p.—Guaranteed
New and Rebuilt Gas Engines

INDEPENDENT FIELD SERVICE, INC.
505 Monigomery St., Shreveport, La.
Phone 425-3457

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at WHITING, IND.

Modern 15,000 BSD Fixed Bed HYDROFORMER

Must Remove At Once Will Be Sold As Units Or Piecemeal

3—Steam Driven GAS COMPRESSORS
2495 CFM 205 PSI Discharge
3—Steam Driven
RECYCLE GAS COMPRESSORS
11840 CFM 325 PSI Discharge
1—Electric Driven AIR COMPRESSOR
2760 CFM 325 PSI Discharge 800 HP

DRUMS

8' x 30' 222 PSI Design
6' x 15' 342 PSI Design
6' x 22' 1260 PSI Design

TOWERS

8' x 63'—18 tray 390 PSI
7' x 83'—30 tray 342 PSI
4' x 83'—34 tray 222 PSI

PUMPS—EXCHANGERS VESSELS

Write for Inventory
Send Us Your Requirements

HEAT & POWER CO., INC.

60 East 42nd St., New York 17, N. Y.
310 Thompson Bldg., Tulsa, Okla.

FOR SALE EQUIPMENT

ANOTHER LARGE AUCTION
QUITTING BUSINESS
DIXON DRILLING AND
J. & S. DRILLING CO.'S

Drilling Equipment, Engines, Drill Pipe, Light Plants, Etc.

Healdton, Oklahoma

Beginning Monday, July 31, 1961 at 9:00 A.M. And Continuing Until Sold.

Sale Will Be Conducted on South Highway, Healdton, Oklahoma. Equipment May Be Inspected Anytime Beginning July 21 Until Time of Sale.

Everything Sells To The Highest Bidder Without Minimum or Reservation.

PARTIAL LIST

4—Drawworks; including Wilson Giant, National, Brewster, & U-34
7—Mud Pumps, including 3 Gardner—Denver, 2 Emsco, Oilwell, F-M.
5—Derricks, 4—Lee C. Moore, 1—Franks
17—Engines, Waukesha, LeRoi, Hercules, Continental
6—Rotaries, Brewster, 3—Ideco, Emsco, National
8—Traveling Blocks, 3 McKissicks, 2 Nationals, Brewster, Reagon, Gumbo Buster
4—Hooks, BJ 4125 Triplex, BJ 150 ton
2—Sets tongs, BJ Type C
5—Swivels, Emsco, 2—Nationals, Gray, Brewster
16—Blowout Preventers, Cameron, Regan, Shaffer
17,600'—Drill pipe, 4½" API and Full Hole
5,100'—Line pipe, 2" and 3"
25—Drill Collars, 4½ H90, etc.
2—Rotary Hoses
4—Light Plants, 10½ KW, 17½ KW, 30 KW
1—Air Compressor
3—Weight Indicators, Cameron, Martin-Becker

Rams and Drilling Spools—Welding Machines—Fishing Tools—Kelly Drive Bushings—Tool Houses, Dog Houses—Water Pumping Unit—B.O.P. Closing Units—Shale Shakers—Slips—Elevators—Swabbing Units—Flanges—Rod Weights—Sub-structures—Pipe Racks—Drill Line—Couplings—Bales—Misc. Subs. Hundreds of Miscellaneous Items, Too Numerous to Mention.

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DRILLING RIG for sale to highest bidder, Unit Rig U-15 with Hydromatic brake and feed control, 127 foot Lee C. Moore Cantilever Mast, 4" O.D. drill pipe, etc. Inventory list will be mailed together with bidding instructions upon request. All bids must be post market not later than July 17, 1961. Shell Oil Company, P. O. Box 1509, Midland, Texas, Attn: Mr. J. W. Benn.

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Lengths 20 ft. square cut ends.
Weight 78# to the ft.
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Indiana-Ohio Pipe Co.
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12' PRESSURE SPHERE 330 PSI @ 650°F
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Compressed GAS DRYER Kemp Model 505
400 Sq. ft. U.S. Auto-Jet FILTERS (2)
63800#/hr. Deaerating Feedwater HEATER
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2'4"x19'5"x3/8" ELUTRIATOR
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2325GPM @ 272' Worth 6HD3 Chr Trim (2)
450GPM @ 1160' Pacific 3" Type J 3 Stg (4)
506GPM @ 311' Pacific 4" Type SVS
315GPM @ 1115' Worth 3UQ2 4 Stg Chr Trim

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310 Thompson Bldg., Tulsa, Okla.

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2½ to 4 x 6 GASO DUPLEX PUMP. Powered XAH Waukesha. V-belt drive. Skid-mounted, 4-wheel trailer. Good condition. $700. Wm. Reilly, 4152 Brookline, Bartlesville, Oklahoma. ED 3-0677.

FAILING 1500, truck mounted, complete with air compressor and service truck. Also, Star 45 spudder, rated 4500'. Prices right. Pressey & Son. Pueblo, Colorado.

AN INVESTMENT! Productive advertising is an investment rather than an expenditure. Experienced oil men have found that The Oil and Gas Journal is their best classified advertising medium.

FOR SALE: 2 Franks double drum units with Spudding attachments. All tools complete. Phone after 5:00 p.m. 1171. Jack Ekas, 110 W. Strothers, Seminole, Okla.

FOR SALE—Lufkin pumping unit, Type SO-36, Gear Ratio 9.94-1, Serial #26-U, 41.4 H.P., Twin crank 204,930# Peak Torque, 25,000# Beam Capacity 74" stroke floor clearing sub-structure. This unit is new and has never been used. Contact: Overton Supply Company, Overton, Texas.

1500 FAILING, long mast, kelly, compressor, 1500' drill pipe, complete, $7,750.00. Failing 2500 58' mast, 5 x 8 pump, sell, trade, rent. Box M-472, The Oil and Gas Journal, Tulsa, Oklahoma.

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We will buy Plants for dismantling. Any size or location.
Let us bid on your next offering for part or complete Plant, Refinery or Equipment.
References furnished upon request.

STAR WRECKING COMPANY, INC.
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KEnwood 7-2500

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Senior Petroleum Engineer and drilling Superintendent for Mexico on land/offshore drilling and production. Contact: M. Cannan, 1645 Milan Building, San Antonio, Texas.

PROCESS ENGINEER

For thermal design of direct fired furnaces. Two or three years experience in refinery process design with operational background preferred. Contact:

R. H. Goodman, Personnel Manager
Yuba Heat Transfer Corporation
3515 Dawson Road, Tulsa, Oklahoma

HELP WANTED

OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma.

PROCESS ENGINEER. Experienced in Petrochemicals, Alkylation, Cat-reforming, Cat-cracking and other refining units. Refinery located in Midwest. Box M-468, The Oil and Gas Journal, Tulsa, Oklahoma.

COMPUTER ENGINEER experienced in petroleum refining economics and capable of directing operations of a computer section. Position is in the Manufacturing Department of a major integrated company located in the Mid-West. Send complete resume to Box M-474, The Oil and Gas Journal, Tulsa, Oklahoma.

GAS PLANT Superintendent, experienced engineer needed for 375 MMCFD gasoline plant to be constructed in Florida. Successful applicant must have 10 years experience. Engineering degree is preferred. Send resume in confidence to Mr. North, Coastal Transmission Corporation, 520 Bank of Commerce Building, Houston 2, Texas.

GEOLOGIST—For Houston Independent. Must have good experience South Louisiana and Texas Gulf Coast and willing hard work both field and office. Salary $10,000 plus benefits. Send resume and photo to Box M-444, The Oil and Gas Journal, Tulsa, Oklahoma.

PROCESS ENGINEER

Mid-West Refinery has opening for experienced Process Engineer. Must be a graduate engineer, preferably Chemical, and have background in practical and technical aspects of petroleum refining. Here is an opportunity with a growing company. Submit complete resume of experience, education, and salary expected. Reply to:

DERBY REFINING COMPANY
Division of Colorado Oil & Gas Corp.
Attn.: E. R. Jones, V.P. of Manufacturing
P. O. Box 1030, Wichita, Kansas

GULF COAST EXPLORATION MANAGER

Leading Integrated Independent Oil Company looking for Experienced, Aggressive, Imaginative Gulf Coast Exploration Manager. Geologic and Management Experience necessary. Louisiana background desirable. Age 35 to 50 preferred. All replies held in strict confidence.

Send complete resume including salary requirements to:

Box 31 Q 45
The Oil and Gas Journal
4041 Marlton Ave.,
Los Angeles 8, California

HELP WANTED

NATURAL GAS Engineer with engineering degree plus 3 to 5 years experince in plant design or operation for work in the Gulf Coast Area. Amerada Petroleum Corp., Gas Department, P. O. Box 3040, Tulsa, Oklahoma.

PETROLEUM ENGINEER for sales work Houston Manufacturer of gas lift and oilfield production equipment. Give resume of experience. Our employees know of this ad. Box M-418, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED PETROLEUM Engineer or first class field man who knows production and normal field operations. This job is far above average and compensation far above expectation. Furnish complete resume. Box M-443, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPERIENCED ELECTRICAL-Instrument Engineer for large midwest refinery. Must be qualified to develop and engineer electronic control systems. Send complete resume including salary requirements to: Box M-442, The Oil and Gas Journal, Tulsa, Oklahoma.

LARGE INDEPENDENT producing company needs petroleum engineers for drilling and completion, workovers, and secondary recovery operations, in district offices. Positions open in Texas, Louisiana and North Dakota. Should have three to six years experience. Starting salary commensurate with experience and ability. Send complete resume of education and experience and recent photograph to Box 1262, Dallas, Texas.

PROCESS ENGINEER

At least three years experience gasoline plant or refinery design, salary commensurate with experience. Send resume with first letter.

Box M-473
The Oil and Gas Journal
Tulsa, Oklahoma

EXPLORATION GEOLOGIST

Well established and aggressive independent company requires the services of an exploration geologist with at least 8 years experience in the Rocky Mt. area to open Denver office. Successful applicant will receive salary plus interest and will direct company's geological effort in originating and reviewing prospects in the district with the assistance of junior geologist. Reply giving details concerning age, experience in various basins, references and salary required to:

Box M-469, The Oil and Gas Journal
Tulsa, Oklahoma

CHEMICAL ENGINEER

Petroleum refinery process engineer with minimum of three years experience. Ability to evaluate raw charge feed stocks and blend finished products. Salary open with excellent fringe benefits. Long established independent refinery located in major center of Louisiana. Our employees know of this ad. Submit complete resume of experience, education and salary requirements. Write:

Box M-459, The Oil and Gas Journal
Tulsa, Oklahoma

SITUATIONS WANTED

PRODUCTION FOREMAN: 35 married, 7 years experience, completions, work-overs, water flooding. Will relocate. Degree. Box M-440, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER: GEOLOGICAL, 9 years in East and South Texas, diversified experience, production geology, reservoir engineering, drilling and development, and production engineering. Box M-451, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER. Ten years diversified experience in drilling, completion, workovers, water flooding, gas injection, writing reports and recommendations, evaluations. Box M-470, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM ENGINEER—Production manager, seventeen years experience drilling, production, oil and gas property evaluation, reservoir engineering, administration and management. B.S. degree Petroleum Engineering, LL.B degree Law. Complete resume on request. Box M-466, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 27, B.S. University of Texas 1957. Four years Tex-La wellsite and subsurface experience. I desire to be affiliated with an independent or major oil and gas exploration company. Also I will consider geological work on an interest basis. Resume of experience on request. Box M-471, The Oil and Gas Journal, Tulsa, Oklahoma.

SALES ENGINEER, B.S. Petroleum Engineering, minor in Geology. 14 years sales and service experience. Familiar with operations and personnel in entire Rocky Mtn. region. Licensed pilot, age 40, married, complete resume upon request. Box M-476, The Oil and Gas Journal, Tulsa, Oklahoma.

REGISTERED PETROLEUM Engineer, Saskatchewan and Illinois, B.S. degree University of Pgh., age 41, married, two children. Eighteen years diversified experience in production, reservoir and evaluation engineering, drilling and completion. Last five years served as chief engineer for major oil company in Saskatchewan. Have had experience in Illinois basin and Michigan. Desires position with independent or financial group. Will relocate anywhere in USA, Canada, or Alaska. Above average academic and professional background. Complete resume upon request. Box M-445, The Oil and Gas Journal, Tulsa, Oklahoma.

SERVICES

COMPLETE LEASE and title service. J. A. Buchanan, P. O. Box 1344, 313 Peoples National Bank Bldg., Tyler, Texas.

MONEY RAISING

WANTED—CAPITAL to help develop a 25 million dollar placer gold mine. Qualified Engineer's report available to interested parties. C. L. Craig, Box 790, Plainview, Tex.

ROYALTIES

PAY CASH FOR producing royalties or over-rides. Send available information first letter. Write Box 441, Bartlesville, Oklahoma.

LEASE AND DRILLING BLOCKS

TEN YEAR LEASES—5,000—15,000 acre Blocks—good play areas. Ohio-West Virginia Production. Box 393, Marietta, Ohio. Phone 373-6962.

WATER FLOOD PROSPECTS WANTED
Active Oklahoma independent desires to purchase good water flood prospects located anywhere in the Mid-Continent area. Box M-453, The Oil and Gas Journal, Tulsa, Oklahoma.

SOUTH TEXAS AND GULF COAST LEASES WANTED
Active independent desires South Texas and Gulf Coast close in oil and gas drilling prospects. Immediate action on submittal of full information. Box M-452, The Oil and Gas Journal, Tulsa, Oklahoma.

WYOMING, NATRONA County 240 acres Federal lease-Sec. 23, T 29N, R 83. Michael Fanakos, Box 73, Villa Grove, Illinois.

LEASE FOR SALE: 6 active wells. Good production. Warren County, Kentucky. Write Box M-462, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: Oil Producing Lease Two equipped wells, Harvey County, Kansas; 521 South Roosevelt, Wichita, Kansas. Murray 3-2835.

NEED TO SELL part interest to help drill offset to discovery well producing 50 bpd. Shallow depth, 850 ft. New pool near Tulsa, 80 acre lease. Write Box M-477, The Oil and Gas Journal, Tulsa, Oklahoma.

PROSPECTIVE OIL LEASES: Am fee landowner over 2,000 acres near Pan American Petroleum Corporation No. 1 List, Sec. 23, Block 68, Township 1, T&P Survey, stratigraphic test, projected to 8,500 feet. anticlinal axis nearby, Hudspeth County, Texas, leases available Hudspeth, Crane, Terrell Counties, Texas. Write landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

LEASE AND DRILLING BLOCKS

WANTED: Producing oil or gas leases. Oklahoma, Texas, Kansas. Have cash to acquire. Box M-475, The Oil and Gas Journal, Tulsa, Oklahoma.

200 ACRES Near Production on Stratton Ridge, Brazoria County, Texas. Brokers invited. Wallace Miller, 2812 Glendale Blvd., Los Angeles 39, Calif. NOrmandy 4-1913.

OIL AND GAS Lease Available, Sections 561 also 621, John H. Gibson Survey, Block D, Yoakum County, Texas. L. J. Luedecke, 1715 Cromwell Hill, Austin, Texas.

SOUTHWEST CRANE County, Texas: Oil and gas lease, five years primary term, S/239 acres, section 18, Block B-28, PSL survey, 2 miles from new oil gulf devonian shows in sec. 15, Blk. B-28, PSL, Ward County, Texas. Great potential bargain. Write landowner: Jefferson G. Smith, 715 Littlefield Building, Austin 15, Texas.

DO YOU HAVE A LEASE TO SELL? For as little as $5 per week you can tell your proposition to over 45,000 oil men through The Journal's classified advertising pages. You'll be surprised how many are interested.

HAVE 100,000 ACRES of Ohio and West Virginia Oil and Gas Leases in Appalachian Basin Area for immediate sale in the Multa Million acre lease play scattered in and through major companies holdings, specializing in 50 to 60 thousand acre blocks David Law, 716 Union Trust Building, Parkersburg, West Virginia.

PRODUCTION, 100 acres, 2 Tar Springs Wells, Butler County, Kentucky. Take 190D Mercedes and cash or H. J. or K35 Beech. 395 acre block, 80 acres held by production. 10-9S-7E, 4 miles South Eldorado, Illinois. Good prospect from Palestine thru McCloskey. Take cash or interest in well. George M. Robertson, Harrisburg, Illinois.

APPALACHIAN NATURAL GAS PROSPECT

9,000 acre lease block immediately off-set by major company holdings. Commercial five to twenty year leases. Yearly rental of $.50 per acre paid quarterly in advance. Active leasing area. Thorough geological report prepared by eminent Appalachian geologist available on request. Principals only. Kindly reply on individual or Company letterhead. Box M-447, The Oil and Gas Journal, Tulsa, Oklahoma.

Will sell a few "several thousand acre checkerboards" of leases in various areas in Pennsylvania and Ohio where seller will promptly test Oriskany, Holderberg, Medina and deeper formations—no pro-ratios—ready market @ 27 cents per M.C.F. Seller willing to participate in drilling deals with responsible buyers. Excellent success record of seller includes recent significant Oriskany gas pool discovery in Ashtabula County, Ohio and "Shearer Oil Pool" discovery in Coshocton County, Ohio in 1952. Write to:
James I. Shearer, President, James Drilling Corporation
258 Newport Road, Blairsville, Pennsylvania

CALIFORNIA EOCENE LANDS

40,000 acre block covers most lands on Ortega, Tule Creek, Matilija anticlines, not far from Ventura Ave. field with its 8 producing zones, 3 of which are over 1,000 ft. thick and big rich gas yield. Will lease all or blocks, reasonable terms and drilling requirements. Sub-Lessors, Box 293 South Pasadena, Calif. SY 9-7921.

BUSINESS SERVICE

DELAWARE CORPORATION formed and serviced American Guaranty & Trust Company. P. O. Box 487, Wilmington, Delaware.

SELECTED RECOMMENDATIONS for the monthly filing of Federal simultaneous oil and gas leases available. Geological and Leasing Associates, Inc., P. O. Box 1194, Denver 1, Colorado.

NEED ESTIMATING HELP?

If you are estimating a Refinery, Chemical Plant or other type of industrial project and need help

Write or Phone
RICHARDSON ENGINEERING SERVICES
BOX 927 DOWNEY, CALIFORNIA
TELEPHONE TOPAZ 1-5022

PRODUCTION WANTED

WE WANT TO BUY MINIMUM 100 BARRELS OIL PRODUCTION PER DAY

Minimum 50,000 barrels remaining primary reserve; complete well history must be furnished together with all available engineering data. Reply Sage Oil Company, 200 Centennial Building, Denver 2, Colo.

MAPS

LEASE MAP
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Scale, 1"—4,000'

Sleepy Hollow, Silver Creek, Ackman, other fields.

Wells, locations, dry holes, etc.

Owners, leasees, expiration dates, physical features.

$25 cash, $26 billed.

Revised editions at half price to map owners.

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TULSA, OKLAHOMA

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▶▶▶ Personals

(Continued from Page 207)

president, production, in 1959. Hines succeeds **Hamilton Rogers,** who recently joined Champlin Oil & Refining Co.

Dr. Irving Tashlich has been named catalysis group leader in Monsanto Chemical Co.'s plastics division, Springfield, Mass.

T. A. Trax, Gulf Oil Corp.'s area production manager in Salt Lake City, has been transferred to Wichita Falls, Tex., as production manager. The Salt Lake City office will be closed.

Superior Oil Co.'s Albuquerque district office has been moved to Farmington, N. M. Making the move were **Don Mathews,** district geologist; **Bob David,** district land man; and **Roland Partridge,** district geophysicist.

David E. Baldwin, Jr., has joined Continental Oil Co.'s research and development department as research scientist, production-research division. **David A. Kuhn** has joined research and development as a production-research chemist.

Dr. Imrich Klein has joined Esso Research & Engineering Co. as chemical engineer in the chemicals-research division. **Dr. Harold Gladstone** has joined the company as chemist in the special-projects unit and **Dr. Manfred Prager** has joined the staff of the products-research division as a chemist.

R. L. Marsh, geologist with British-American Oil Producing Co. in Billings, Mont., has been transferred to Denver. **M. E. Hennes,** geologist, and **J. D. Mohrle,** land man, will move from Billings to Casper, Wyo. The Billings office will be closed August 1.

John Frayne, acting area shift leader of utilities and sulfur recovery at Tidewater Oil Co.'s Delaware City, Del., refinery, has been promoted to shift leader. **Frank L. Studier,** operator in the alkylation-polymerization area, has been named acting area shift leader, alkylation-polymerization.

WHITE

Kenneth T. White, vice president and a director of Warren Petroleum Corp., has taken over responsibility for operations of Warren's LPG division. He succeeds **G. L. Brennan,** senior vice president. Brennan will continue as a consultant to the company until he retires December 31.

O. C. Kerr, district engineer for Continental Oil Co., has been transferred to Lyons, Kans., from Wewoka, Okla.

A. Knox Tyson, exploration vice president for Producing Properties, Inc., will head the company's new Houston exploration office.

T. C. Parker has joined Gulf Research & Development Co.'s production-engineering division as research engineer.

George H. Kimbrell has been named manager of operations for Oil Production Maintenance, Inc., Houston drilling contractors. He will headquarter in Houston. Kimbrell was with Reed Roller Bit Co. before joining Oil Production Maintenance.

N. E. Luker has been promoted to senior mechanical engineer in control-systems engineering at Humble's Baytown, Tex., refinery. **R. M. Sharp** has been promoted to senior chemical engineer in catalytic cracking. **Dr. W. J. Farrissey** has been promoted to senior research chemist in the research and development division at Baytown.

H. R. DeVinna, Central Exploration Co., has been elected president of Geophysical Society of Oklahoma City. Other new officers are **B. M. Flynn,** Tenneco Oil Co., first vice president; **J. M. Saunders,** Sunray Mid-Continent Oil Co., second vice president; **D. L. Amonett,** Kerr-McGee Oil Industries, secretary; **Francis G. French,** Atlantic Refining Co., treasurer; and **Jack Oden,** Mobil Oil Co., district representative.

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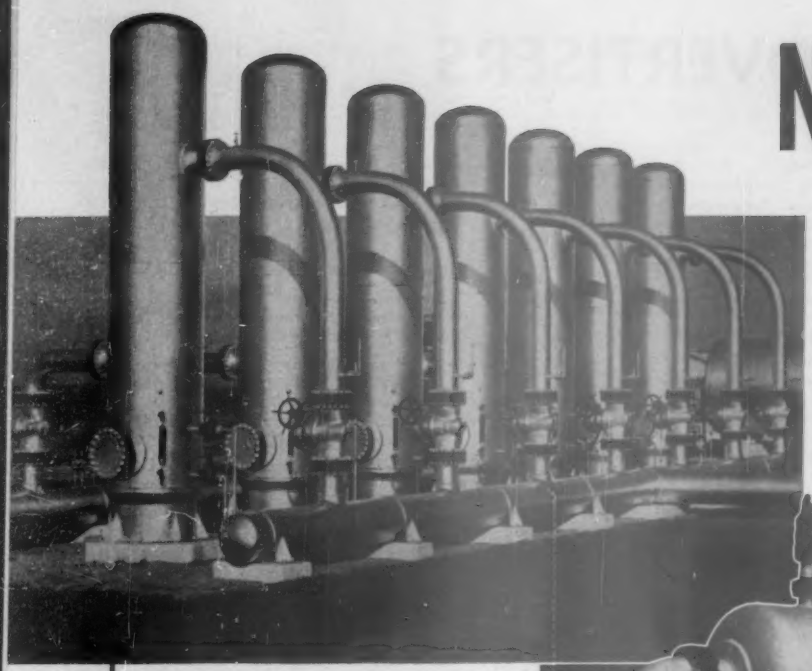
NATIONAL® GAS SCRUBBERS

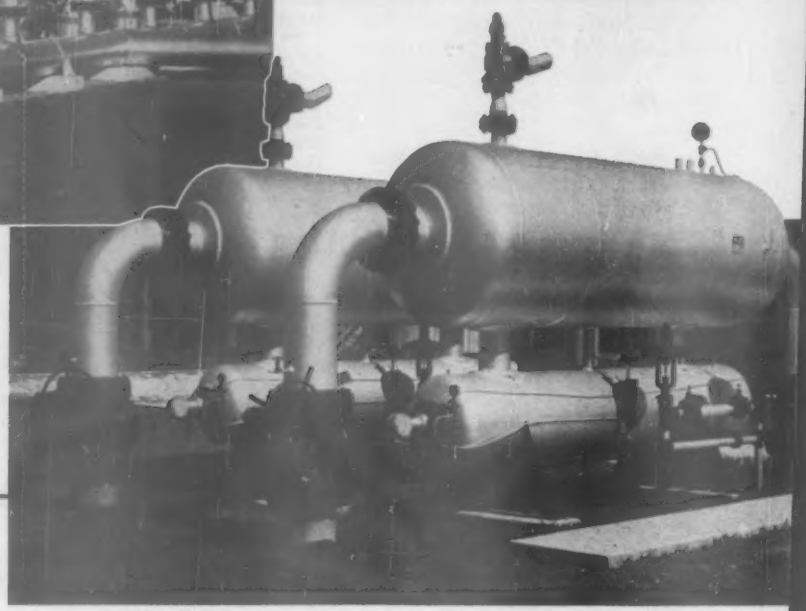


54" x 20'—750 PSI National Vertical Gas Scrubbers, Batesville, Miss.

VERTICAL

or

HORIZONTAL



48" x 10'—500 PSI National Horizontal Gas Scrubber, Westwego, La.

National Gas Scrubbers efficiently and economically remove liquids, both water and hydrocarbons, to assure the delivery of clean, dry gas to consumers.

National Wet and Dry Vertical and Horizontal Scrubbers are available in all sizes, working pressures and capacities to fit the needs of gas producers and carriers. National Scrubbers are available in sizes from 12" to 96" and larger . . . 100 PSI to 4000 PSI and up. We invite all inquiries on any kind, size or working pressure.

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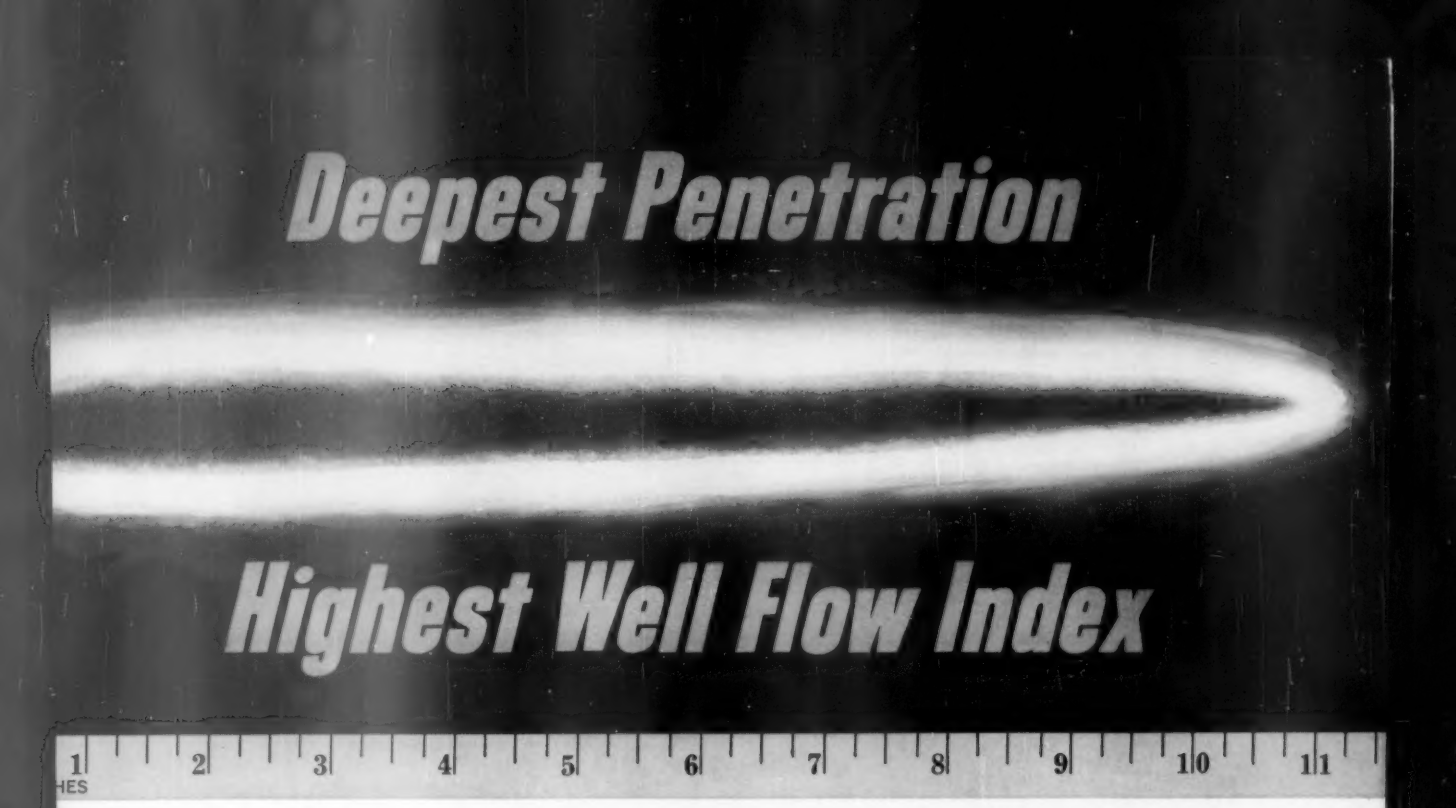

Lane-Wells KONESHOT Perforators

with the new, more powerful NCF II Charge

22-28% greater penetration, 30-37% higher WFI

Lane-Wells' continuous program of intensive research in perforating methods and explosives has resulted in the development of the new NCF II (Non-Carrot-Forming) charge, size for size the most powerful shaped charge available in the industry. With this new charge, the high performance characteristics of the widely used Koneshot Retrievable Perforators have been greatly increased, with penetration and Well Flow Index superior to any other casing perforators.

Now, for the first time, an NCF charge is available in the 3⅛" Koneshot gun, extending its range beyond that of any other gun of its size. With the addition of this new smaller size, Koneshot NCF guns are now available in a range of sizes for perforating all casing 4" and larger. They are available in various lengths and combinations, with a maximum of 96 shots per run in the 3⅛" size and 128 shots in the 3⅜" and larger guns. Each may be loaded with a shot density from one to four shots per foot.

Koneshot guns have established an enviable performance record for deep, clean, carrot-free perforating. Now, with greatly increased penetration and the highest average flow rate published for any casing perforators, they are far and away your best buy in shaped charge perforating.

The new NCF II charge is available in 3⅜" and larger sizes in all areas. The 3⅛" NCF II, while now in limited distribution will soon be available at all locations. Ask your Lane-Wells representative for full information or write for descriptive brochure.

HIGHEST PUBLISHED PERFORMANCE FIGURES IN THE INDUSTRY FOR COMPARABLE GUNS.

Koneshot NCF II	Clearance	Ent. Hole Diameter	Total Penet. (Berea)	Per Cent Increase	Well Flow Index	Per Cent Increase
3⅛"	½"	.389"	8.25"	22%*	1.40	37%*
3⅜" or 4"	½"	.40"	10.9"	28%*	1.80	30%*

Performance figures are average of 10 shots.

* Over previous Koneshot charge

LANE-WELLS CO.
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